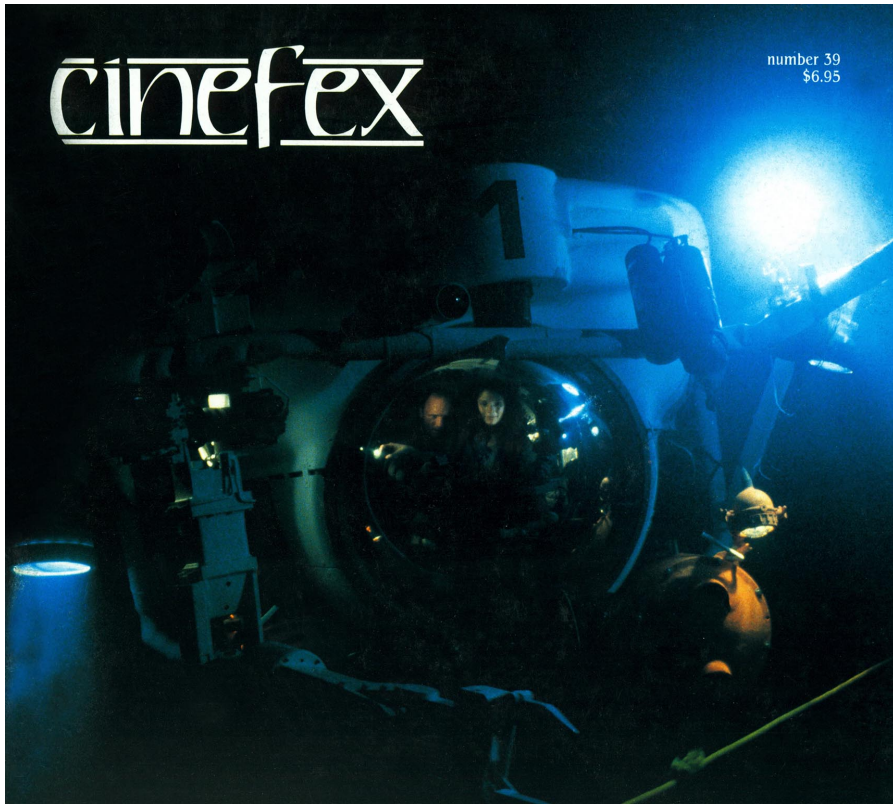


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...the journal of cinematic illusions

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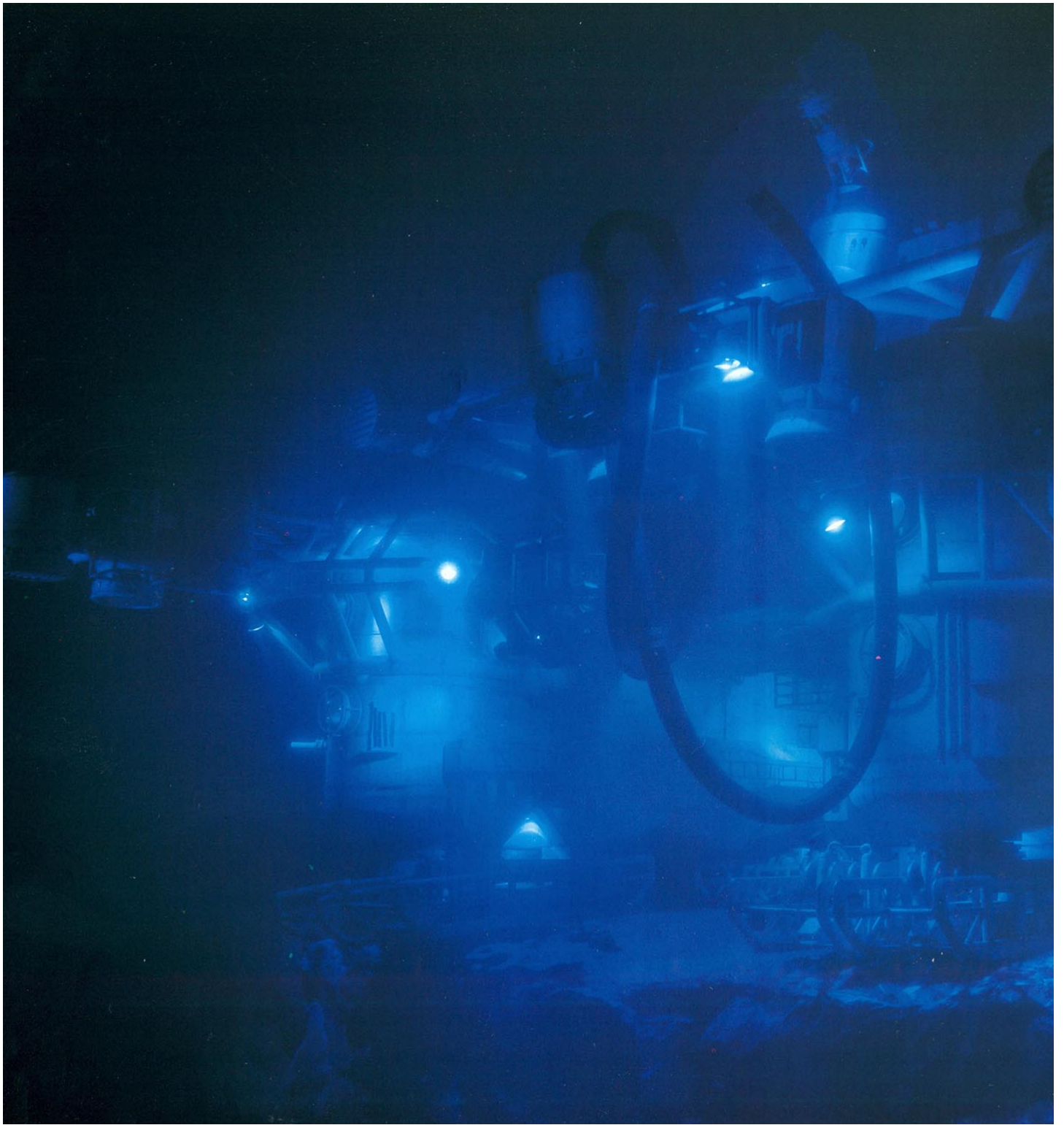
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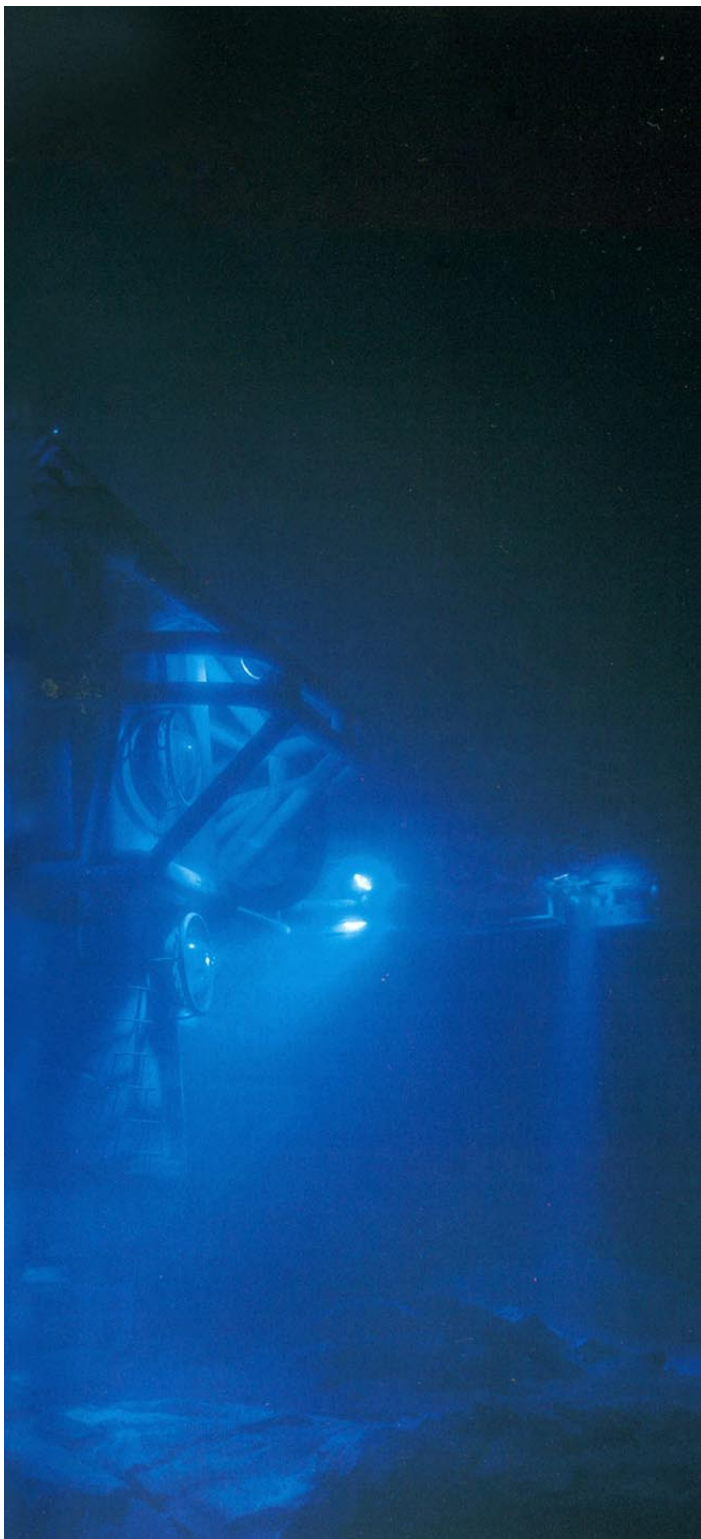
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Dancing on the Edge of the Abyss 4

Writer-director James Cameron and producer Gale Anne Hurd have carved a distinct niche for themselves in the world of high-tech science fiction filmmaking. After traveling across time in *The Terminator* and to the outer reaches of deep space in *Aliens*, they have now journeyed into the Cayman Trough — one of the deepest and most impenetrable chasms on earth — for *The Abyss*. Set in an underwater oil drilling habitat located seventeen hundred feet beneath the ocean surface, the film begins with the search for a downed nuclear submarine and evolves into an aquatic odyssey of cosmic consequence. Forty percent of the production was shot in the largest fresh water filming tank in the world — a specially converted reactor containment building located at an uncommissioned nuclear power plant. Nine visual effects units were engaged to produce literally hundreds of shots covering the gamut of cinematic illusions from computer generated imagery and motion control to animatronic puppets and radio control vehicles to matte paintings and underwater miniatures to rear projection and bluescreen traveling mattes. Virtually no effects technique was left untapped. A trio of distinguished effects supervisors — John Bruno and Hoyt Yeatman and Dennis Muren — oversaw the activities of in-house units and teams from Dream Quest Images and Industrial Light and Magic. Ancillary units were headed by Cameron veterans Robert and Dennis Skotak and Gene Warren of Fantasy II. Though photographed thousands of miles apart — in situations both wet and dry and by artists of diverse talents and experience — the effects blended together seamlessly with the main unit photography and with one another. The end result is an unprecedented and uncompromising accomplishment — an epic film of wonder and imagination propelled by the singular vision and relentless drive of a master filmmaker just hitting his stride. *Article by Don Shay.*

FRONT COVER — Lindsey Brigman pilots the Cab One submersible in *The Abyss*.
A nonterrestrial being found deep in the ocean in *The Abyss* — BACK COVER.





DANCING ON THE EDGE THE ABYSS

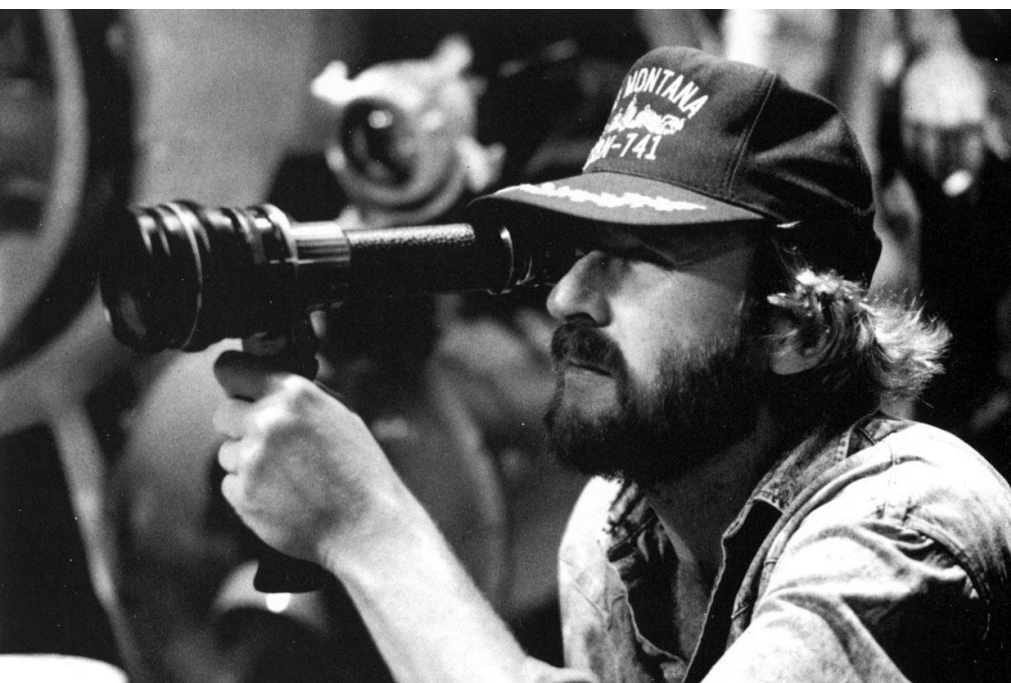
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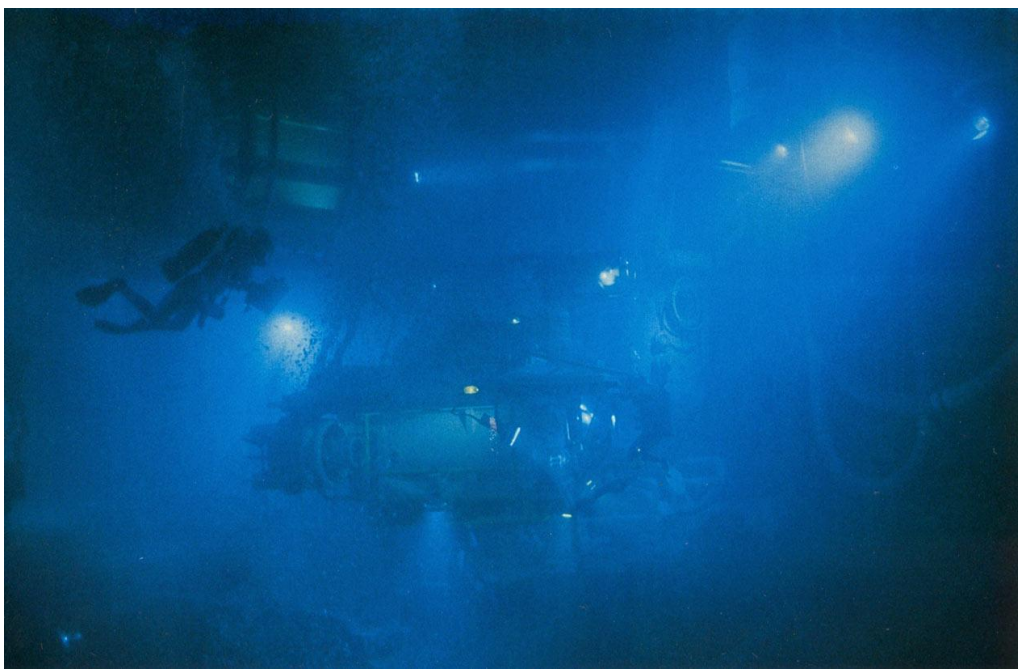
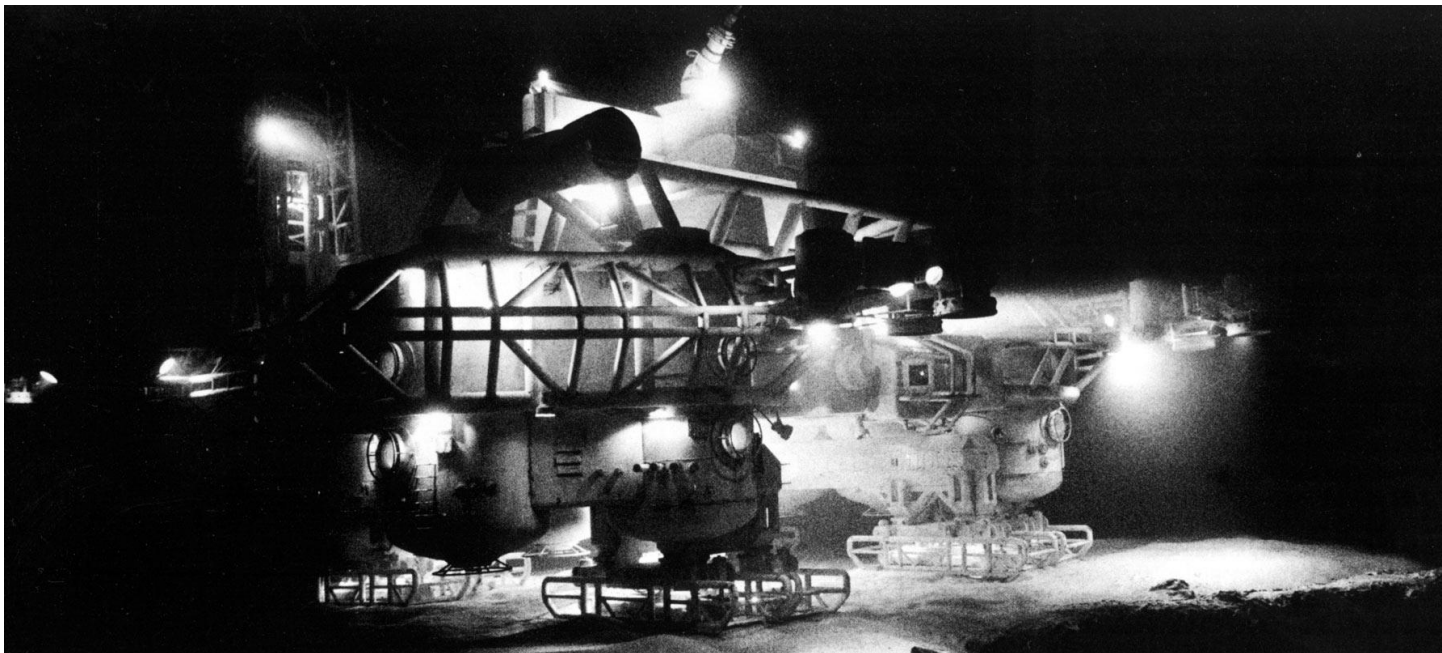
the storyboarding phase. "I hired Phill Norwood to work with me on the boards and between us we did them all. Meanwhile, Jim was trying to convince me to be effects supervisor. I was hesitant to commit fully; but since my own project was still in limbo, I agreed to help him hire an effects company and place all the shots." Before that could be done, the storyboards had to be logged into a computer and then put into book form so they could be sent around to all of the major effects houses for bids. "The most difficult part of the process was getting the effects budget down somewhere within this stratosphere. When Jim and I first began talking about it, I looked at everything

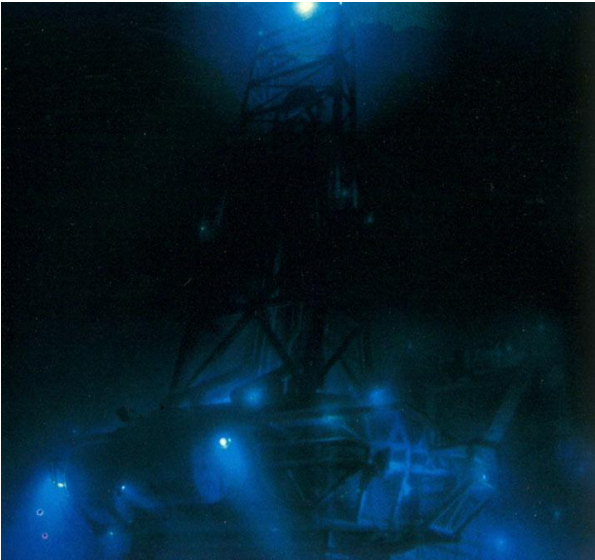
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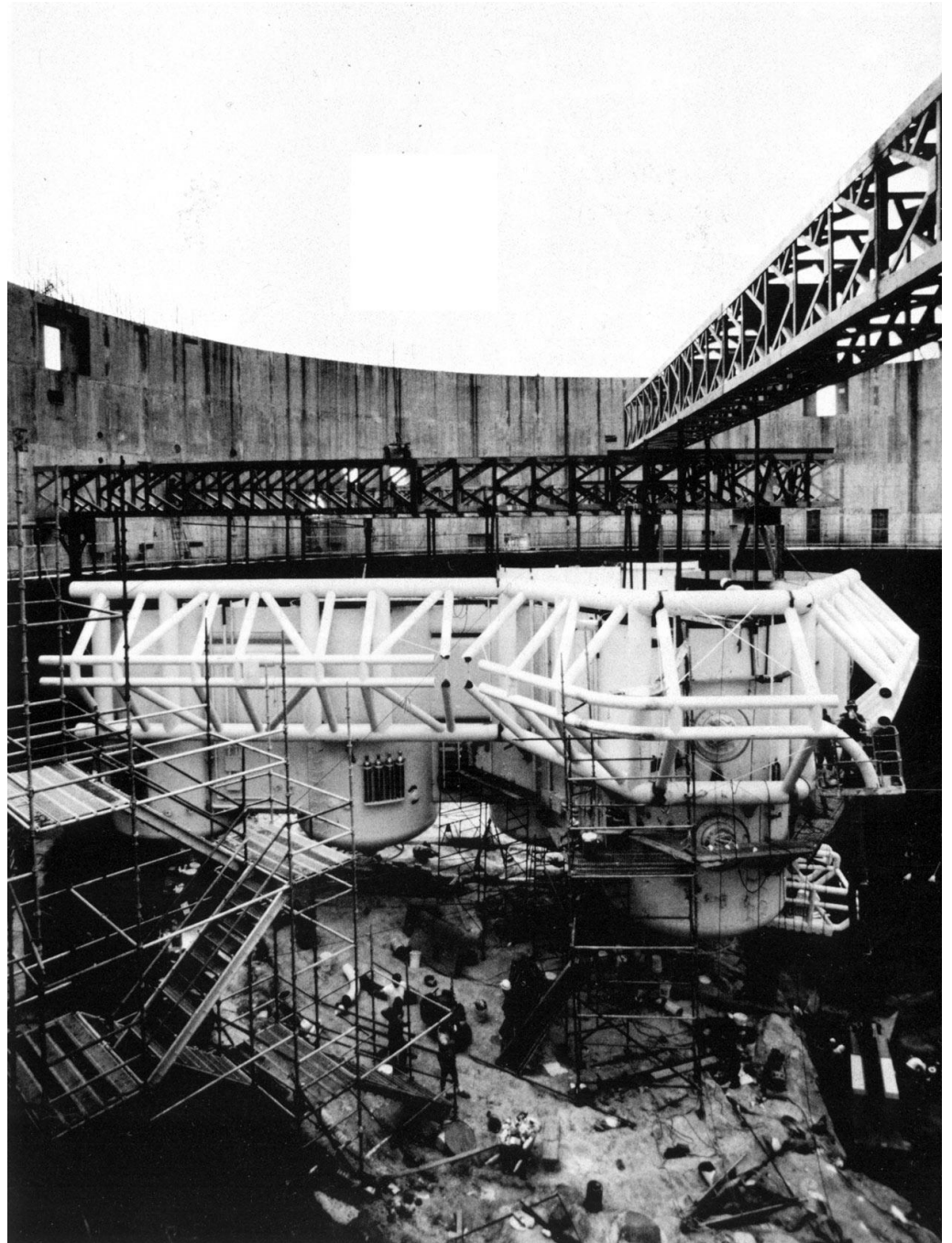
"The lowest bid was \$13 million million," Cameron shuddered. "I sus than any other effects bid in history was not going to get made. Fox had and we had spent some money on s there was no way anyone was going I recovered from shock, I decided to began by cutting out eighty of the sixty effects shots. Then I divided technique. There would be model sh would be model shots done dry-for-be surface miniatures and matte pa erated imagery. In all — seven distinct groupings. Two of them — the wet-for-wet shots and the su cided we would do ourselves. Any dealing with would have to set up s it made sense not to pay someone could just as well do them oursel production. The remaining five we could bid on more than one unit, award them separately if I chose to up. It also took the fear factor out o matter how hard the shots were, a s be manageable over a nine- or ten-m the most intensely competitive effe started getting back some good nu was completed, Dream Quest Image Magic emerged as the principal pla on the production docket.

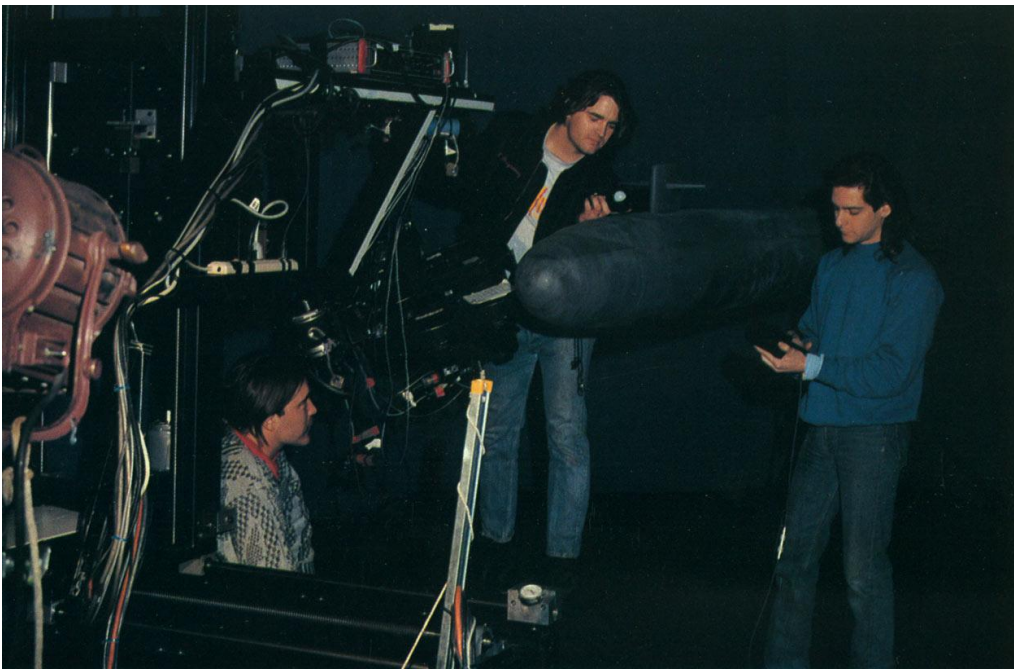
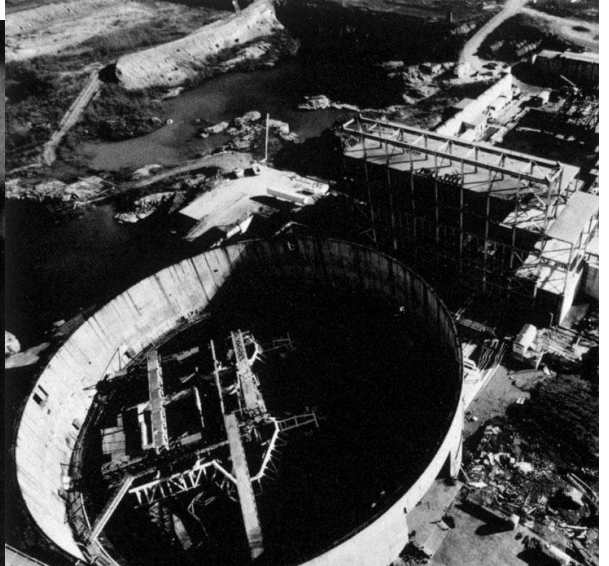
Cameron and Hurd — both exper to filming *The Abyss* anywhere bu There would be no smoked stages w Only the real thing was acceptable the scripted action taking place un

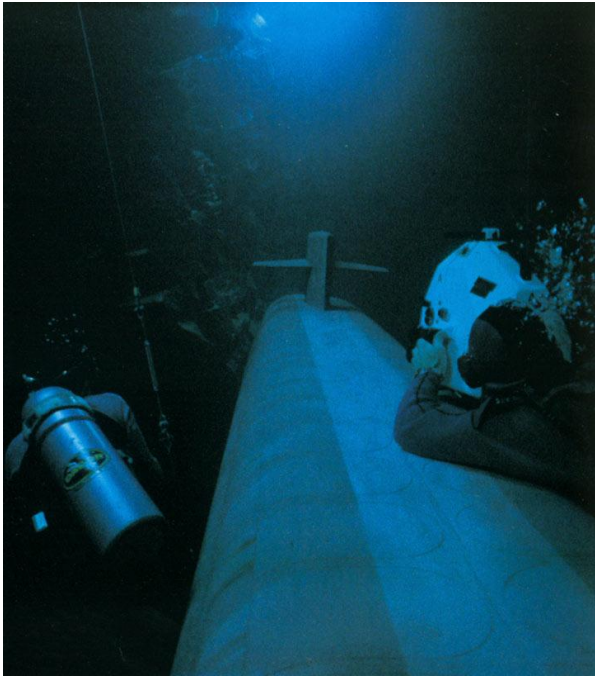


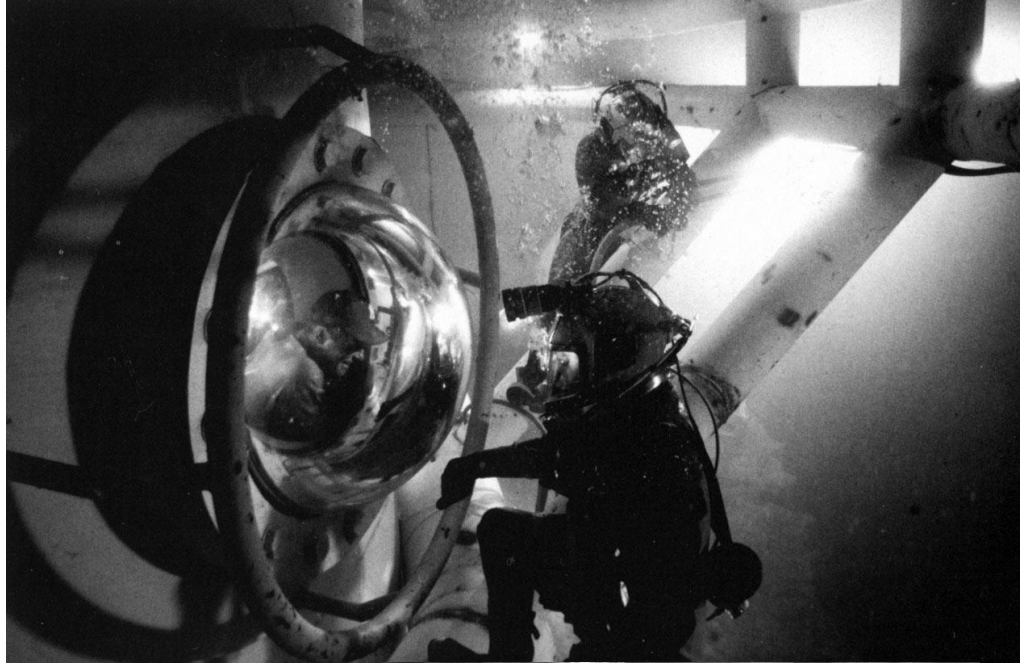


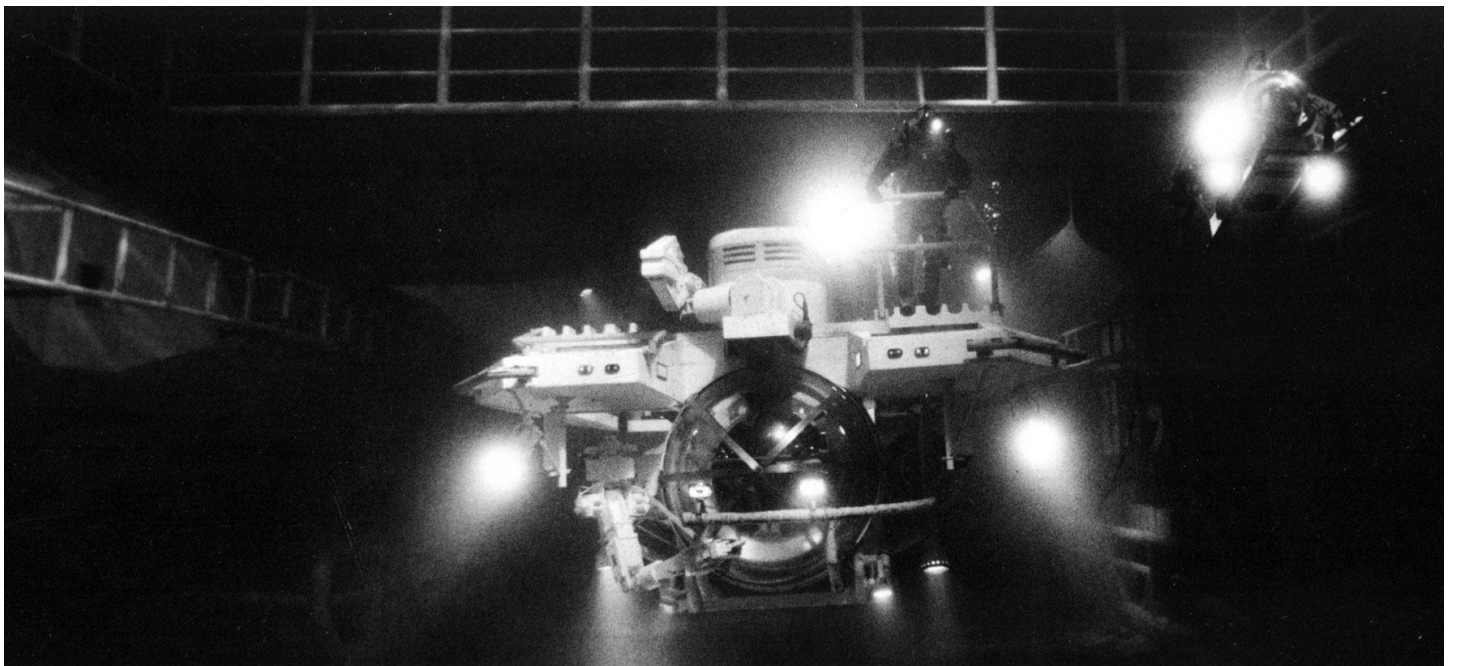
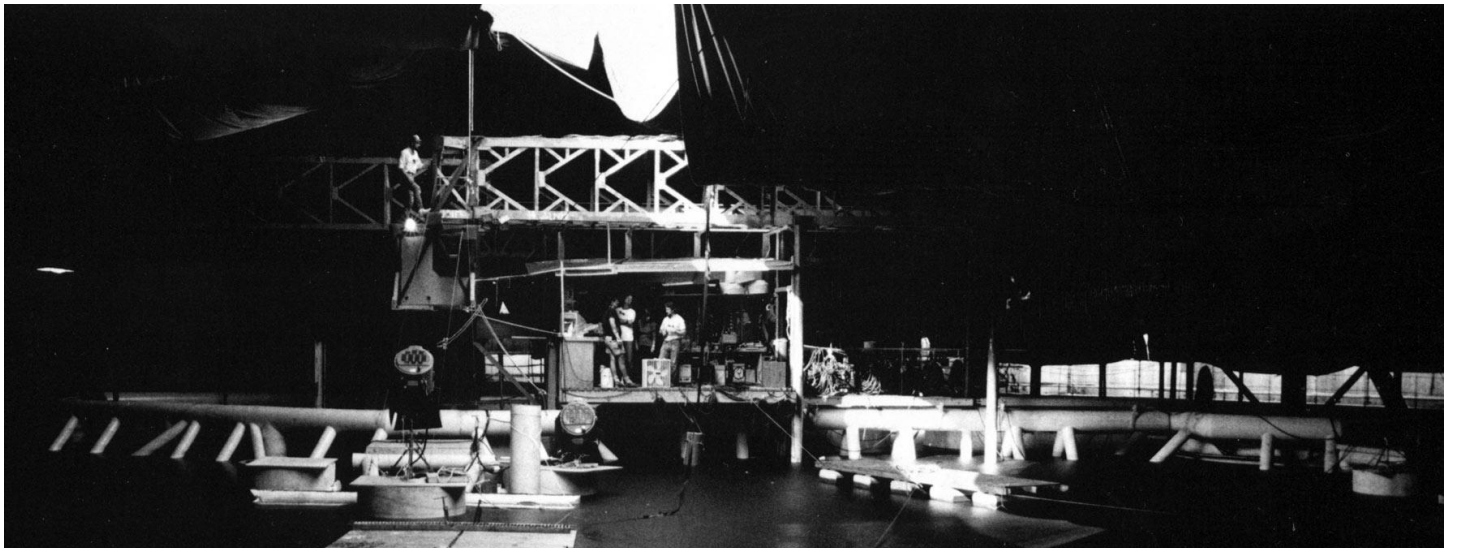




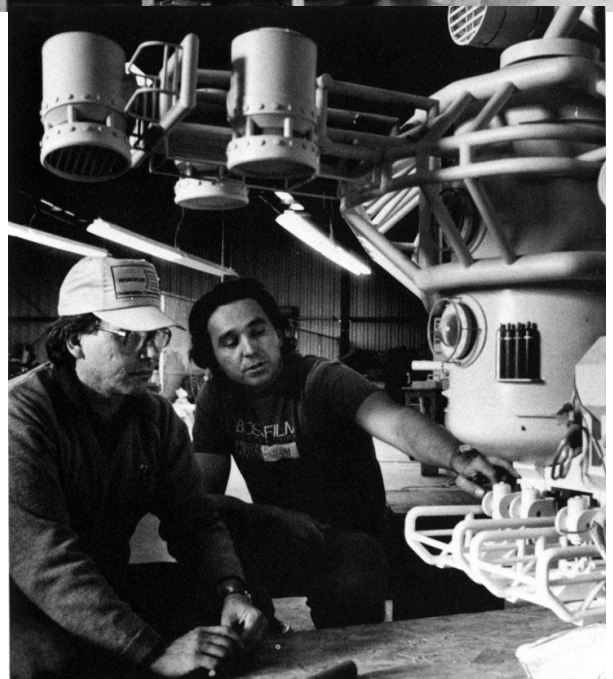




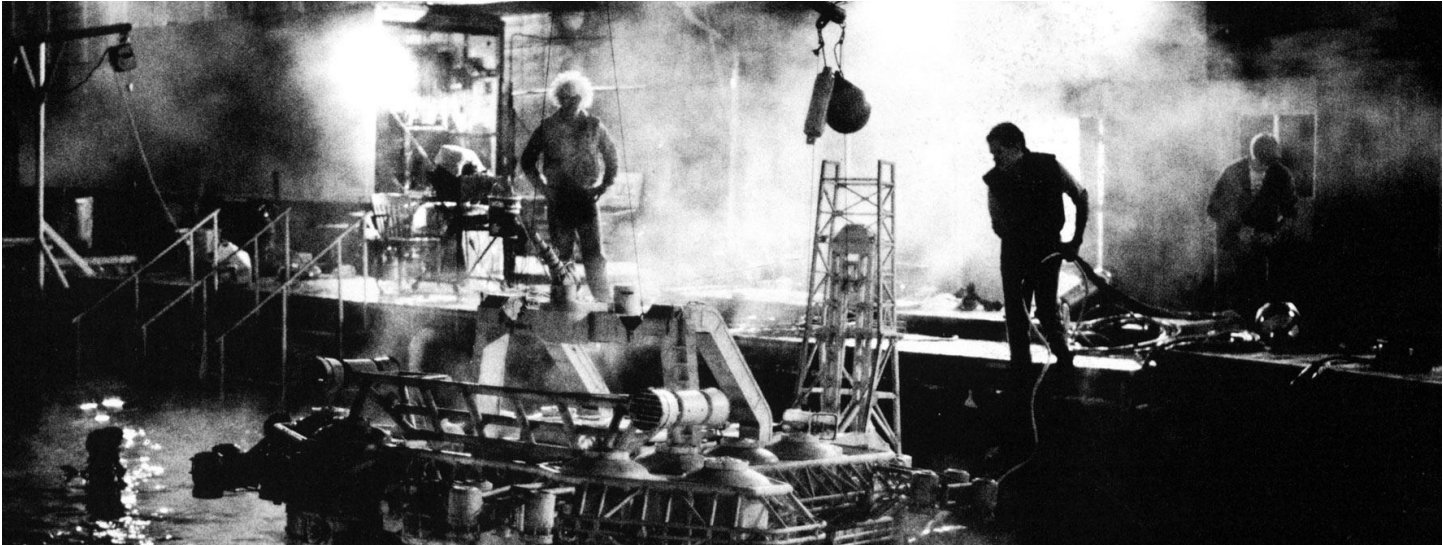








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ticals, anything we gave them in that format would have to be reduced to Vistavision for compositing and then reduced again to 35mm for release printing. The feeling was that that would produce too much of a generational loss, so the decision was made to save a duping step by switching most of the optical plate work over to Vistavision. By the time they came up with the camera they were going to use, we had less than thirty days to build a housing for it. Fortunately everything came together in time." All of the Hydrolmage housings — two made specifically for the film, plus three from their existing inventory — featured reflex viewing, remote start capability and a video tap for remote previewing. Housings used by the main unit were provided by Al Giddings and his Ocean Images firm.

Although most of the underwater photography would be accomplished with hand-held cameras maneuvered about by free-swimming operators, many of the scenes Cameron envisioned would require greater speed and mobility than divers alone could provide. Single-engine scooters had traditionally been used for this purpose — with cameras mounted on top and steered through the water — but Cameron considered them underpowered and self-limiting. A diver propulsion vehicle with advanced capabilities specific to its role as a camera mover was considered essential. Since no such system existed, Cameron enlisted his younger brother Mike — a mechanical engineer and ultralight flight instructor — to develop one.

"Jim wanted to be able to move the camera underwater in ways that had never been done before," Mike Cameron noted. "It had to move forward at fairly quick speeds — also vertically and backwards so that he could get a variety of tracking moves." Assisting on the assignment was Vince Catlin — a longtime friend and fellow ultralight enthusiast. "We built four prototypes — which were essentially foam shells covered in fiberglass with a camera mount in front. Each unit had two adjustable-speed propulsion thrusters configured so that they could propel the camera up and down and do a variety of acrobatic maneuvers. Most scooters have only a single fixed-speed thruster which is not direction adjustable." Another refinement was the installation of leverage-enhancing arm guides on either side of the hull. "The system also allowed us to pull back away from something — one of the most difficult things to do underwater. By mounting the camera on the back of the unit and standing in front of it, the operator could power it through the water backwards. The only other way to do something like that would be to put a rope around the diver and reel him in."

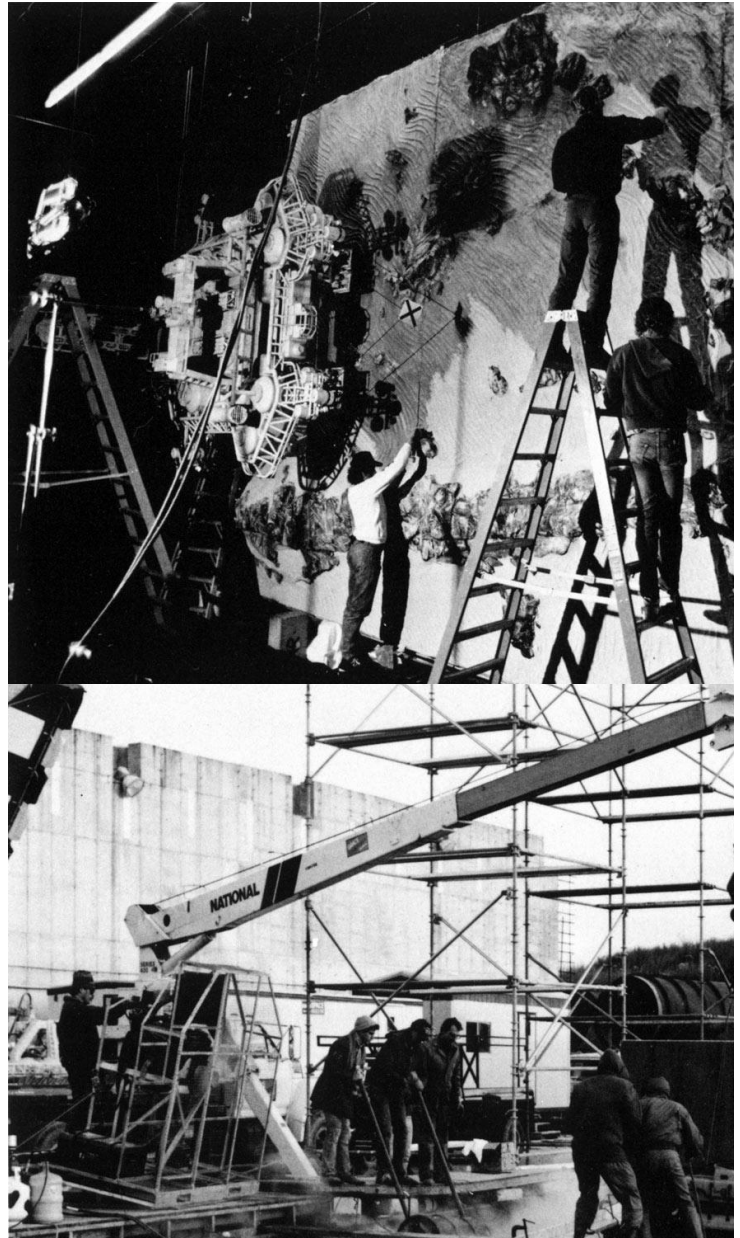
While companies up and down the West Coast were scrambling to meet deadlines critical to the start of principal photography, major problems were brewing in South Carolina. The conversion of the containment building into the largest fresh

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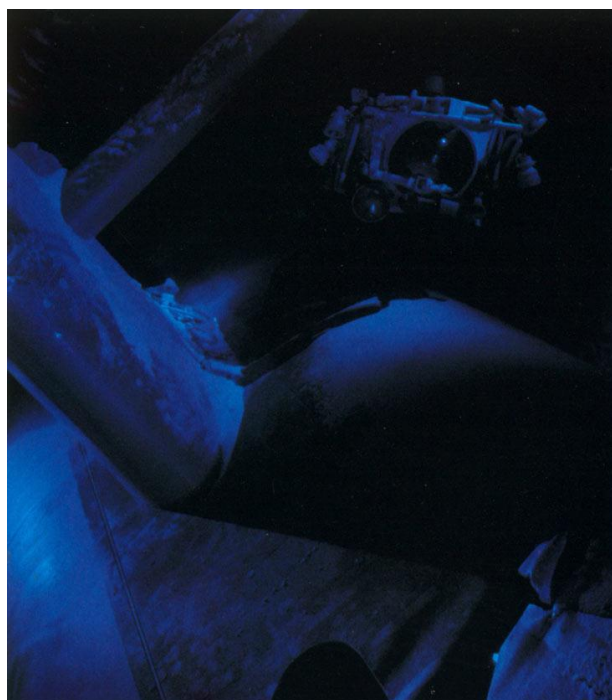
bolts around the windows as the water was coming up. Everything worked out in the end — but it was a real photo finish."

A significant milestone had been passed — but the problems delaying the production were far from over. The tank would not hold water. Although the structure itself was strong enough to outlast the next ice age, the retrofit plumbing was decidedly inadequate to withstand the pressure of seven million plus gallons of water. The first indication of trouble came on the day before shooting was at last to begin in the tank. "It was a Sunday and the studio was deserted except for me and one security guard," Cameron recalled. "After two weeks of trying to cull shooting days out of nothing, I was finally preparing to shoot in A-tank when the guard came running in yelling: 'A pipe's busted! There's water everywhere!' We drove out to the tank at a hundred miles an hour and ran down to the deck area where the pumps and heaters were. We could see a pipe coming out of the bottom of a manifold with a leak in it that was calculated later to be fifteen thousand gallons per minute. Water was falling four feet in a solid column, hitting the deck and spreading out laterally fifty feet. Neither of us knew what the hell to do. There were miles of PVC pipe and valves — it looked like an oil refinery in a crate — and the roar was deafening. The area was already flooded and I had to swamp through mud and rebar just to get to where the valves were. I started closing every one I could find, but the water was still roaring out. Then behind one of the heaters I found a large valve with a lever on the side to provide enough mechanical advantage so it could be turned. I started leaning on it with all my might — all the while straddling this section of pipe that was upstream of the valve. I could hear the water hitting Mach 4 as it pushed through with a high-pitched wail that sounded like a turbo jet engine. Finally the water stopped and there was a moment of silence. I thought, 'Okay, I guess I get to shoot tomorrow.' A week later that pipe I had been straddling exploded like a bomb and blew pieces of PVC hundreds of feet in the air."

Other problems began to manifest themselves. At the ocean depths specified in the script there would be no ambient light. It was therefore important that a sense of total blackness be sustained within the tank and that the only illumination be from practical sources — either the Deepcore habitat or its submersibles or the divers themselves. Cameron was aware that the simplest way to prevent sunlight from filtering into his set would be to shoot at night — but he was hesitant to do so. "It was mainly a function of fatigue and people's biological clocks. On almost any night shoot, people tend to start checking out about three o'clock in the morning — which is not exactly life-threatening on a soundstage, but in an underwater situation with twenty-ton submersibles and hundreds of amps of electric-





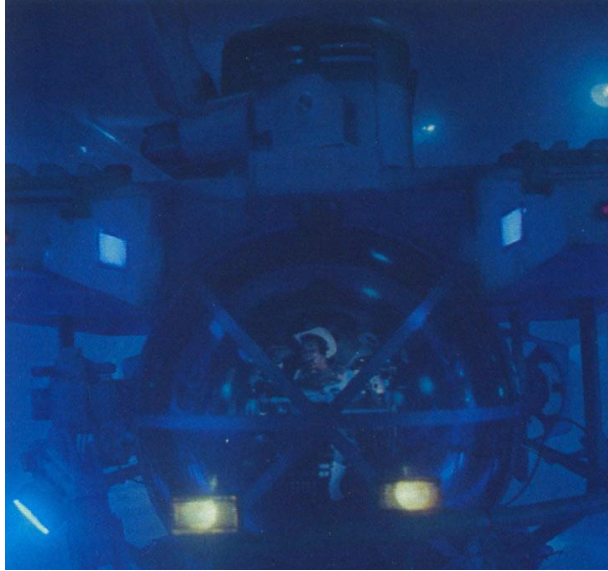


images on the surface that would be visible from below in wide shots. The floating black mass handily broke the reflections while still allowing easy passage of divers and equipment. "We spent the first day in A-tank just throwing some light on the set. Our plan had been to prelight before the water went in, but Craig Baumgarten came down from Fox to solve all our problems for us and decided to fill the tank before we had it lit. So we had a set down there in the dark — somewhere! All we had to do was bump around a bit and find it. With lighting problems and flooding problems and visibility problems, we got very little footage during the first few days. Just about the time things were coming all together, I arrived one morning and found that overnight our giant tarp had split from one side to the other and sunlight was streaming in. There was no way we could fix it. So we were on nights — after six weeks of telling everyone that under no circumstances would we work nights underwater with actors in helmets."

Visibility was an ongoing concern. "We had a problem in not being able to turn the water over fast enough. Oftentimes, whatever we did in that tight ecosystem we had to live with for the next couple of weeks. Our set was dressed with sand and silt and things — and I knew, for example, that if I had Flatbed drive over the escarpment part of the set with its thrusters blasting, I could forget about seeing anything the next day. So we had to schedule the shots based on probable visibility. And shooting six days a week was no help — we never had any recovery time. I would come in on Monday mornings hoping and praying to be able to see twenty feet. It forced me to drop back to wider lenses than I really wanted to use. With wider lenses, you get the same composition through less water because you are closer to the subject — and the idea always in underwater photography is to shoot through the shortest possible water column."

Cameron had been confident from the outset that Al Giddings was the best possible choice for underwater cinematographer. But with a comparable volume of dry photography also on the docket, Cameron needed another cinematographer equally at home on studio soundstages. In selecting Mikael Salomon, he got vastly more than he expected. "Mikael was supposed to be on hand during the underwater shoot to observe through a big window we built in the tank and consult on the overall lighting scheme. But entirely on his own initiative — even against my game plan — he went out and got himself certified in a lake nearby and was in the tank on the first day with his light meter in a little housing that he had made. He was the world's worst

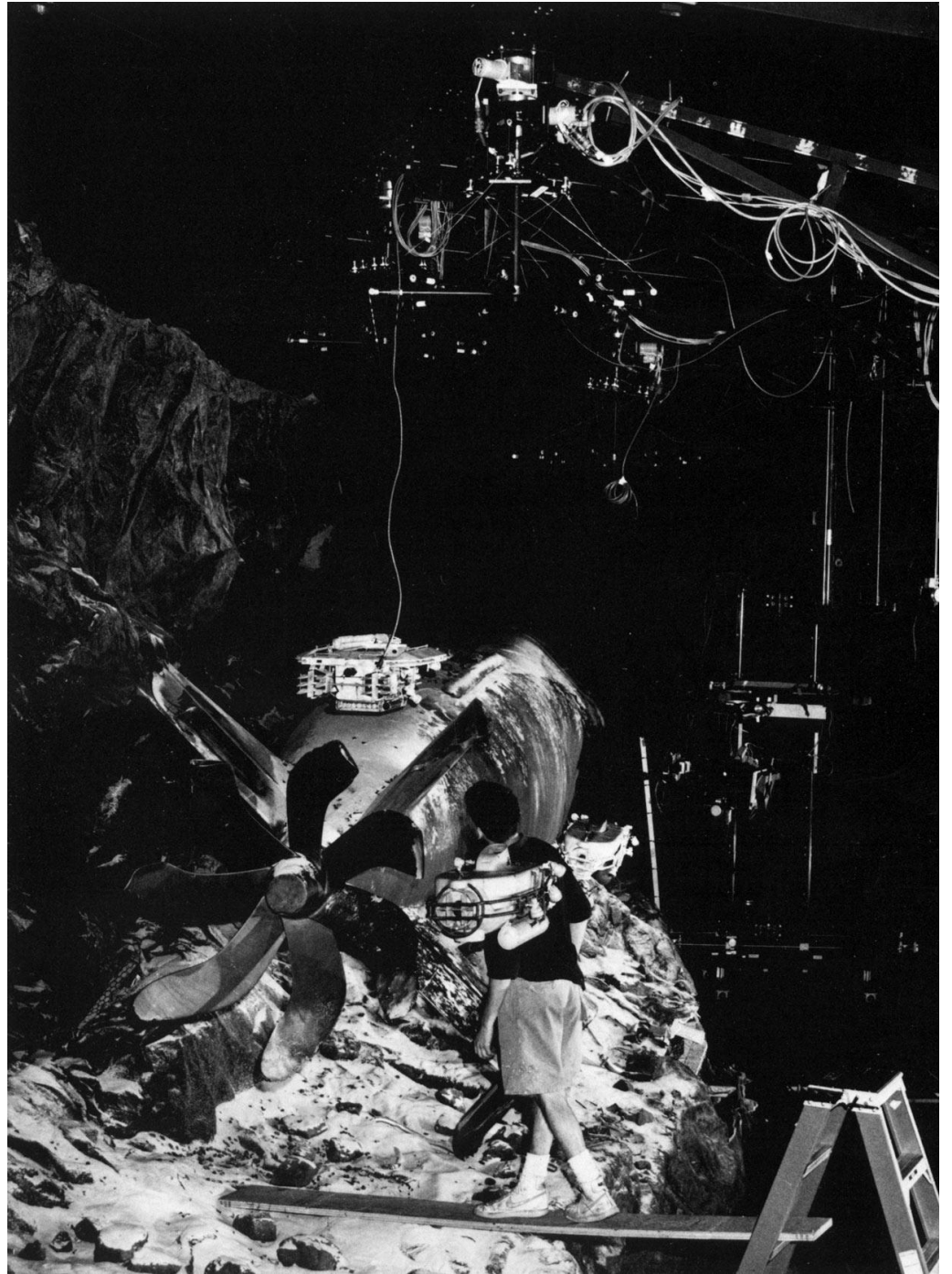
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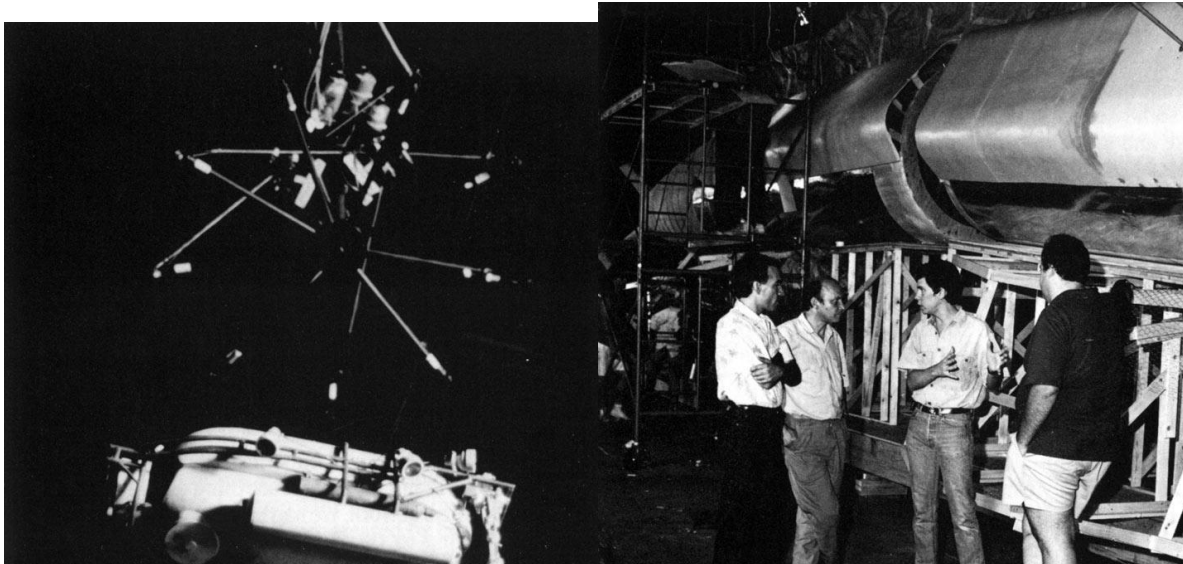


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No one in the production expected an
Jim Cameron had assured both cast and
would be more grueling than they could
was that and more. "Shooting underwater
there is. We were in a life-threatening e
a day, six days a week for eight weeks. On
dives — one before lunch and one after.
hours and twenty-five minutes and the s
and thirty-two minutes — including an h
at the end. That was without surfacing a
told me I was going to do that before I
have made the film — I would have backe
waste even an hour, Cameron spent his
viewing dailies on an underwater video
myself, only Al Giddings and a couple of
divers were allowed to go into decompres
never came close. For psychological and
limit underwater was about two-and-a-ha

Massive leaks continued to plague
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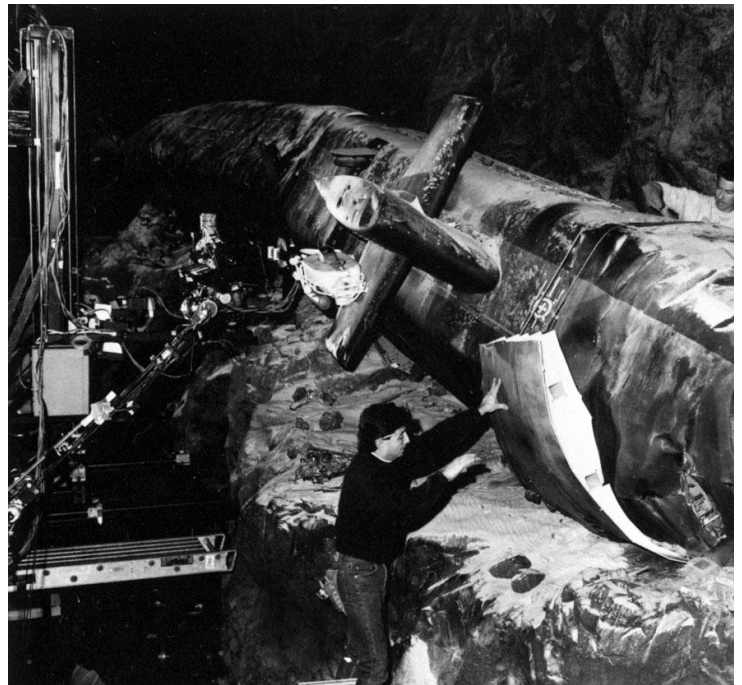
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a few feet in front of Deepcore. Clearly it had to seem massive
— but for a number of reasons it did not. The most obvious
shortcoming was the wax which tended to break apart and float
to the surface. Less obvious was the fact that the body of the
crane was made entirely from a foamed PVC board which is
similar to foamcore only much harder — almost like plexiglass.
Even so, it was full of air and wanted to float. The model would
drop through the water all right, but not at the speed we felt
was needed to suggest great mass."

A number of structural modifications were undertaken. "We
removed all the walls and roof sections from the body and then
pop-riveted them onto a steel box that Larz Anderson made. The
box had a tongue arrangement on the front that allowed the
whole thing to slide back about six inches — kind of like an
accordian. The idea was that we would fill the box with weights
so that when it hit the ground the whole structure would com-
press and look like it was collapsing on itself. In addition to
that, I backed up all the wax with very thin sheet lead so that
it would not crumble and float away. We also distressed some
parts of the crane with heat guns and then repainted it and aged
it to more closely match the crane that was going to be used
in the live-action." When time came for its trial by water, And-
erson hoisted the crane model over B-tank and released it with
a trip wire. "Larz had put fifty pounds of lead into the box —
plus another thirty to fifty pounds in the tongue — and *still* it
just gently hit the bottom. The next time around he put in
another two hundred and fifty pounds. This time the tongue
arrangement slid down as planned and created the impression
of a real impact with a lot of weight behind it. We ended up
shooting the scene eight or ten times. Since we had only two
sets of replacement parts, we had to try to beat everything back
into shape between takes and repaint it. After one or two drops,
most of the plastic pieces fell off. Fortunately, since the crane
was supposed to have broken loose from the *Benthic* and
crashed into the water, we could get away with the fact that it
was not in the best of shape by the time it hit the bottom."

Pete Romano manned the underwater camera for two crucial
shots — a dramatic view of the crane falling directly toward
camera and a reverse angle of it tumbling past and disappearing
into the ocean depths. "The crane was quite large and weighed
a couple hundred pounds. Since it was supposed to have been
torn from the ship, it had to look mangled and battered with

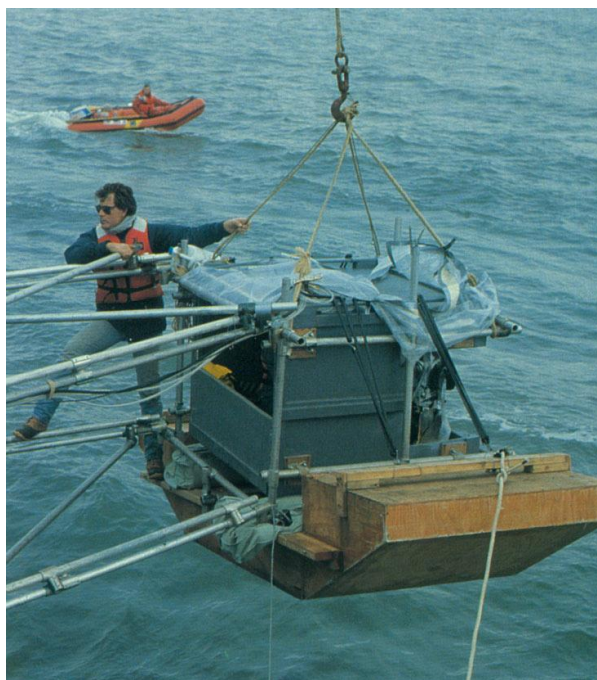


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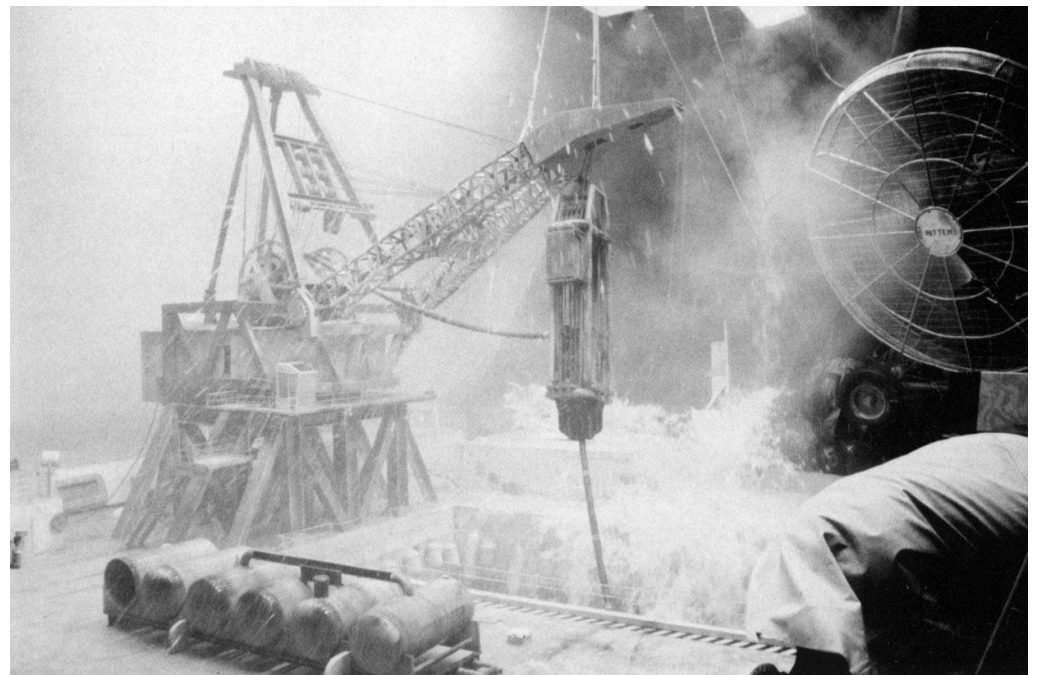
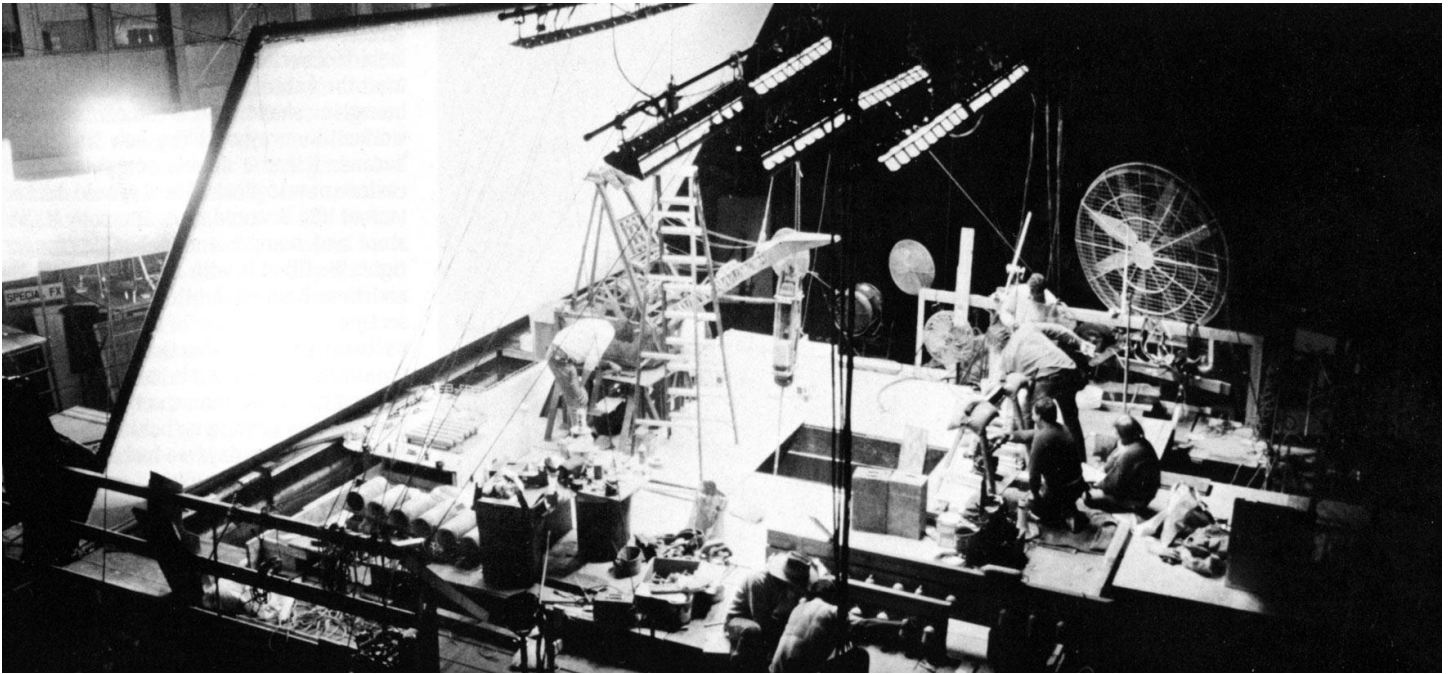
appear into the darkness."

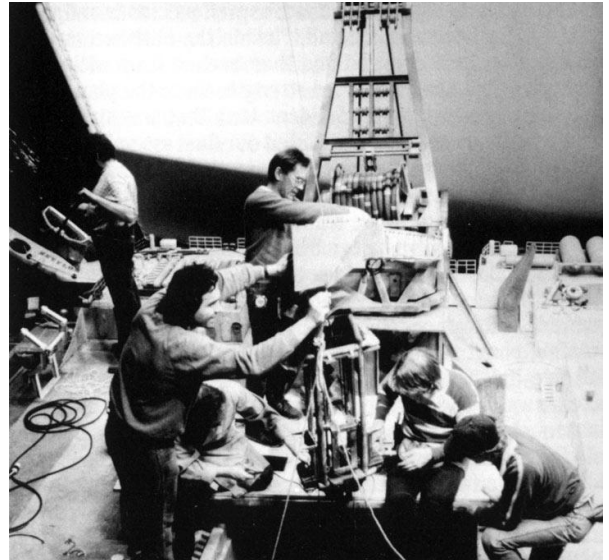
Accompanying the falling crane is seventeen hundred feet of untethered umbilical cable that begins to coil snakelike on and about the imperiled Deepcore habitat. "For the cable that was used in the live-action," said McClung, "the art department had taken one-foot-diameter PVC pipe and wrapped it with a heavy glass cloth and resined it to give it a bit of texture. Then they had painted it gray and every ten feet or so had put two white stripes with an orange reflective stripe in the center. Our job was to match that in miniature. One of the set people was using some waterproof conduit that happened to be the right color gray and came in the right sizes, so we ordered a couple hundred feet of that and then had poor Marghe McMahon tape the whole thing with alternating white and orange stripes. At first we thought that the conduit alone would be heavy enough to fall convincingly and kick up a lot of sand — but again we were wrong. To weight it down, Larz threaded it with some heavy copper cable — but even that was not enough to hit the ground with real force, so finally he solved the problem by filling the conduit with several hundred pounds of lead shot."

Once the crane tumbles into the abyss, the umbilical pays out quickly and begins dragging Deepcore inexorably toward the cliff edge. "Even underwater the model was quite heavy," Romano recalled, "so it required a lot of force to pull it across the set. We tried a number of things and finally ended up putting a block and tackle on the side of the tank to draw the model forward. We also had a couple of divers hidden from view who were pushing it from behind — back where the umbilical was for all of the lights. Since we were shooting at high-speed — usually seventy-two or ninety-six frames per second — the model had to be moving several times faster than it appeared to be on film. The block and tackle had a mechanical advantage of three-to-one and we had five guys really pulling on it — so the model was literally being jerked through the water. What really made everything seem massive was all of the silt and sediment being kicked up on the bottom. Mostly it was very fine sand, but at times we put little globs of fuller's earth where the feet were going to go just to throw a little more stuff around. Plus we had water jets coming down in between the feet to disrupt things even more. For bubbles we used little packets of Alka-Seltzer which gave us a nice scale. Because of the water and the HMIs, a lot of the live-action stuff had a very beautiful blue cast to it that Jim liked a lot and wanted us to duplicate. We tried a lot of things and eventually came up with a combination of blue dye — which was actually a laundry product — and homogenized milk. One of our divers had a sprayer and an underwater fan and he would go in before every take and fog everything up."

To prevent sunlight from filtering down into what was sun-

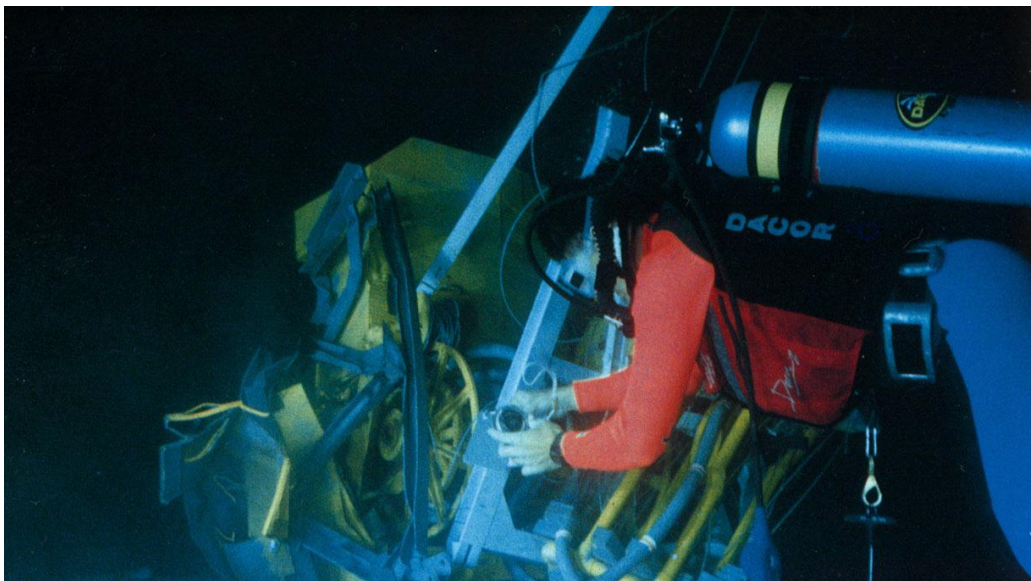
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— so we brought in Flash Gordon." At the time, I directed that construction begin on the water tank in a fashion a skeletal framework for the prototype. I wanted what the frame in the middle had to look like an hourglass shape — so we took that as a guide and worked our way out. The bow was the most difficult because it had a double compound curve. The easiest way to deal with it would be to make a model that looked like it would work and copy it. So I went to a store and bought a model minesweeper. It was just right. We filled it with a solid product that was easy to slice and then I sliced it into sections and built up the sections up to the size of the *Benthic*. He brought us literally the morning that we got the castings. I took them hot out of his hands, laid them out on the table and cut them and then stuck them into place. The crew was coming up behind us laying up the ribs. In only four days we had the entire hull ready for glassing."

The next two days were expended creating a pair of fiberglass castings could be made. Once cured, the shells were ferried from the main facility to the larger annex nearby where they were assembled and detailed. Two crews set to work on one reinforcing the hulls to render them stronger. The other constructing the central deck area to connect them. A third crew at the main facility was producing the bridge and helipad, as well as the dishes and other surface detail. "Inside the hulls, three-quarter-inch plywood and then basic framework of box steel for added strength. We put the film in a tank, we were confident that it was adequate. It was not until we started our first test that we learned from the production company that we instead to take the *Benthic* out into the ocean. We had fifteen-foot waves at it. We realized at that point it was seriously underbuilt, so we put in another layer. Our glasser came back in and reglassed it. Then we put steel box pipe and literally plugged the top and bottom of the mid-deck suspended between them. It was a good proof." To control the level at which the model would sit, we had five independent compartments fitted with take on water and bilge pumps to expel the water. For the final touch, massive doses of polyurethane were poured into the model to insure that it would remain afloat.



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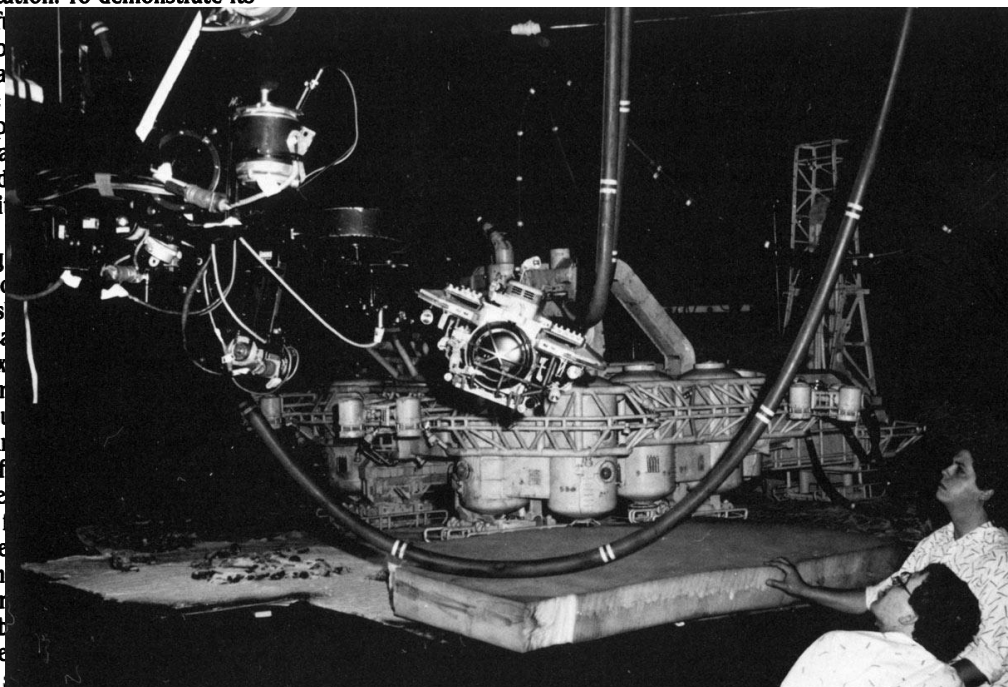
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skewed configuration visually, the f signed so that one end of it could b the tank causing water to wash up a “Originally the plan was to drop the later simplified by allowing it to happ suspended on four pads within the wa scenes where it was partially flooded lower one end of it into its new posi

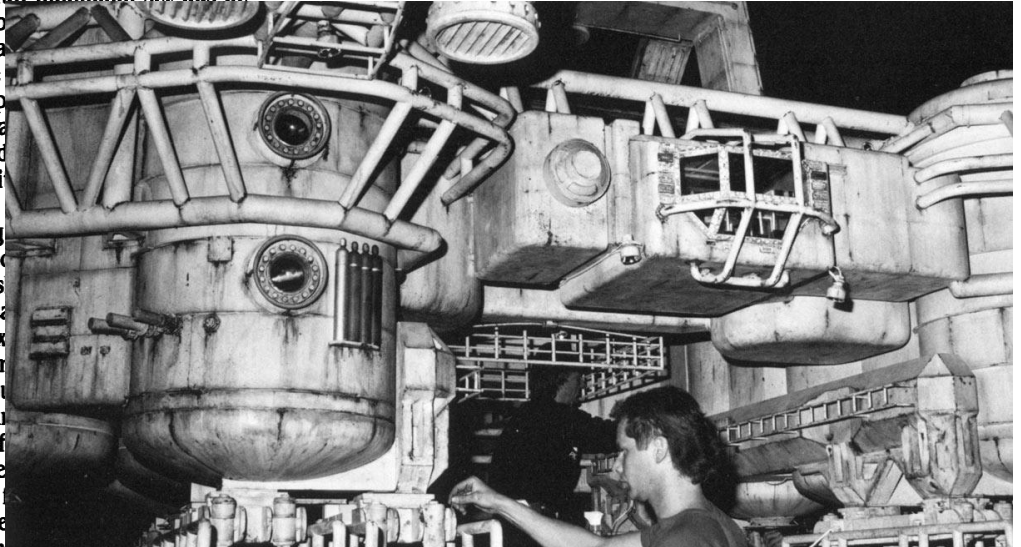
Good fortune and quick response disaster as the rig slams to a jarring trusion at the edge of the abyss. Floe sealed off and flash fires are extinguis lost and the situation is still critica lifeline to the surface, power and ox Lindsey dons her underwater gear ar the damage. As she attempts to rerov of the wrecked modules, a transpar darts out of the abyss behind her f manta ray shape, similarly illumine from the depths and hovers over her ing back into the darkness. No one e objects, but speculations are rampan paranoidly envisions Soviet submer secrets from the downed nuclear sub some form of nonterrestrial intellige her direction that night when the begins to pulsate and congeal into an undulating column of water — a pseudopod probe — that snakes through the habitat like a transparent tentacle scanning its surroundings.

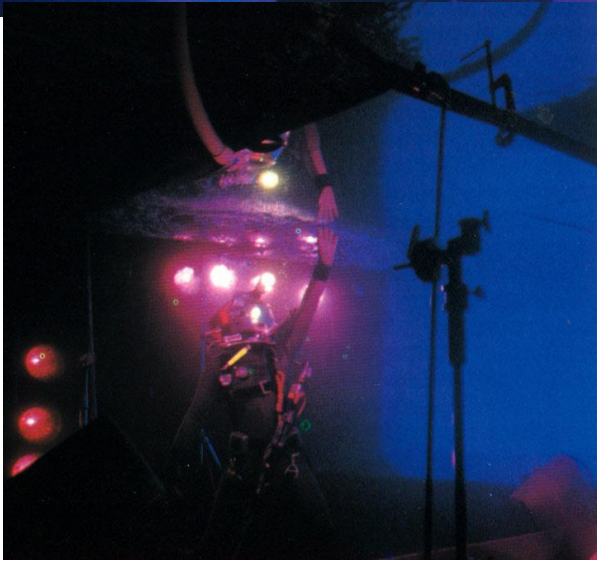
Several options were considered in trying to actualize the pseudopod. “Computer animation was probably the first thing that came into our minds,” Bruno commented, “but we shied away from it initially. Not only were we concerned about how expensive and time consuming it would be, but we were also convinced that the technology was not yet advanced enough to produce something that looked like water and not plastic or chrome. So we worked our way through every other possibility. At one point we considered replacement animation. I had done some of that in *Poltergeist* — for the hand coming out of the TV set — and it seemed likely that we could get a good effect by projecting water ripples onto transparent replacement pieces. But the logistics would have been awful — we had more than a minute of film to produce! Another possibility was clay

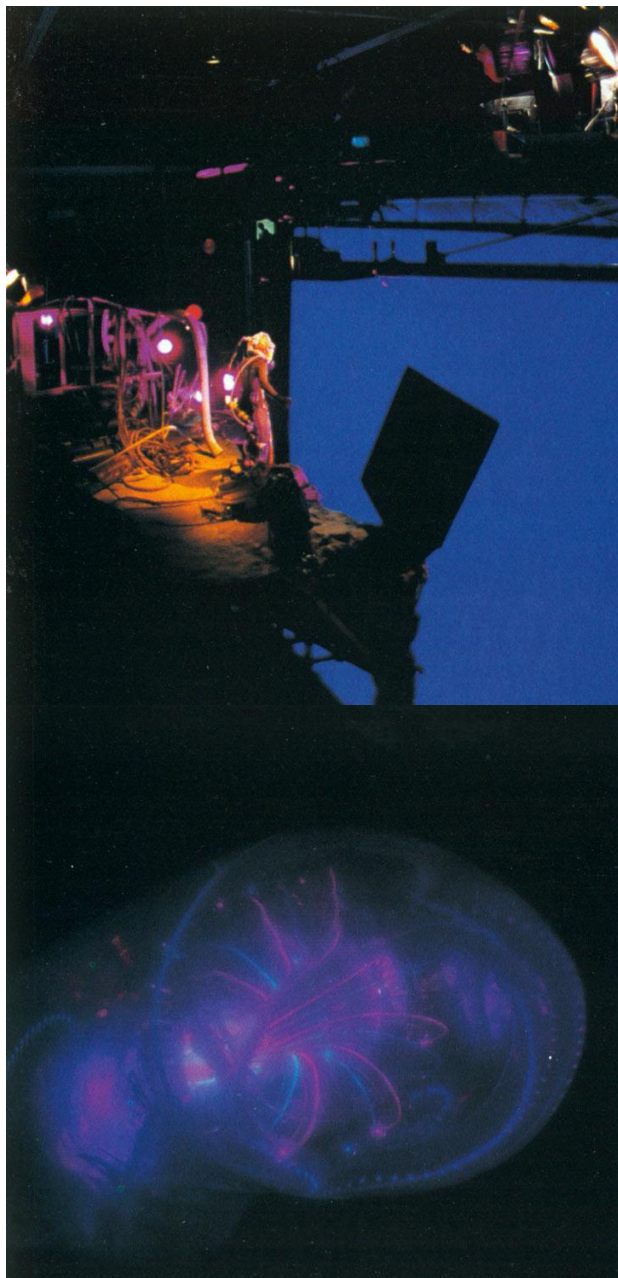


to come to rest in a nonlevel orientation. To demonstrate its skewed configuration visually, the full moonpool set was designed so that one end of it could be tilted by the tank causing water to wash up a side. "Originally the plan was to drop the moonpool set, later simplified by allowing it to happen in a scene where it was partially flooded and then to lower one end of it into its new position."

Good fortune and quick response prevented a disaster as the rig slams to a jarring stop at the edge of the abyss. Floodlights are sealed off and flash fires are extinguished. The situation is still critical, but the lifeline to the surface, power and oxygen is intact. Lindsey dons her underwater gear and attempts to reroute the damage. As she attempts to reroute the damage, a transparent, manta ray shape, similarly illuminated from the depths and hovers over her head, sending her back into the darkness. No one else is seen, but speculations are rampant.







it could be sculpted in clay and then shot stop-motion with water reflections projected onto it. Phil thought about it a bit and then called me and said: 'This is not the way to do this. I think you should give him a call.' When I first heard about the pseudopod, I just about flipped out. It was one of those fabulous ideas that come around all too seldom. So I spoke with Jim on the phone and suggested that he ought to do it with computer graphics. He said he had thought about that, but was worried about the quality and the cost. We talked about setting up a meeting. In the meantime, I thought of another way to do it without computer graphics that was the next level of evolution beyond just straightforward clay animation. The idea was still to accomplish the fundamental shape changes with clay, but then do the edges with cel animation which would be more controllable than stop-motion and would allow us to make the silhouette undulate like water — theoretically at least."

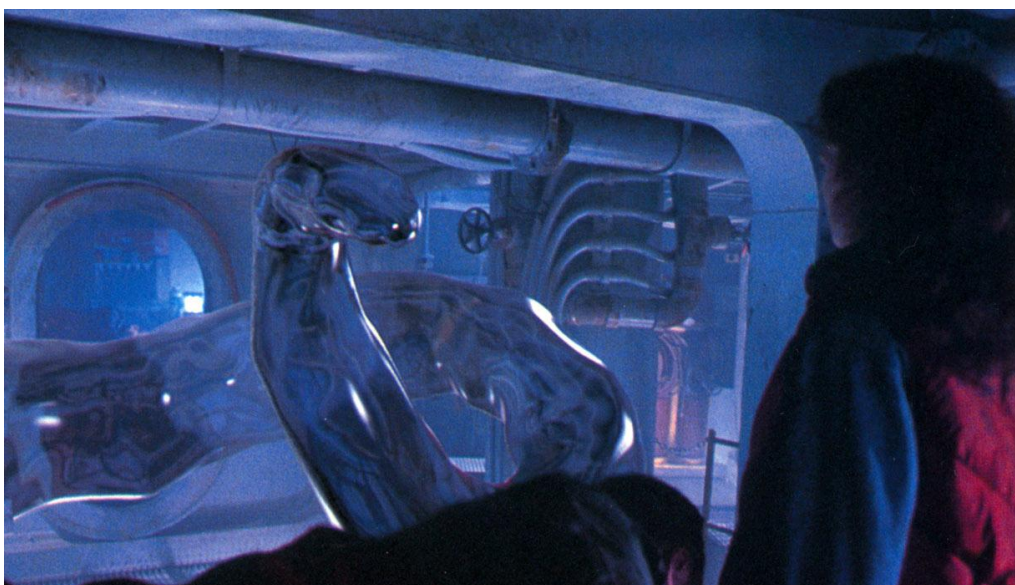
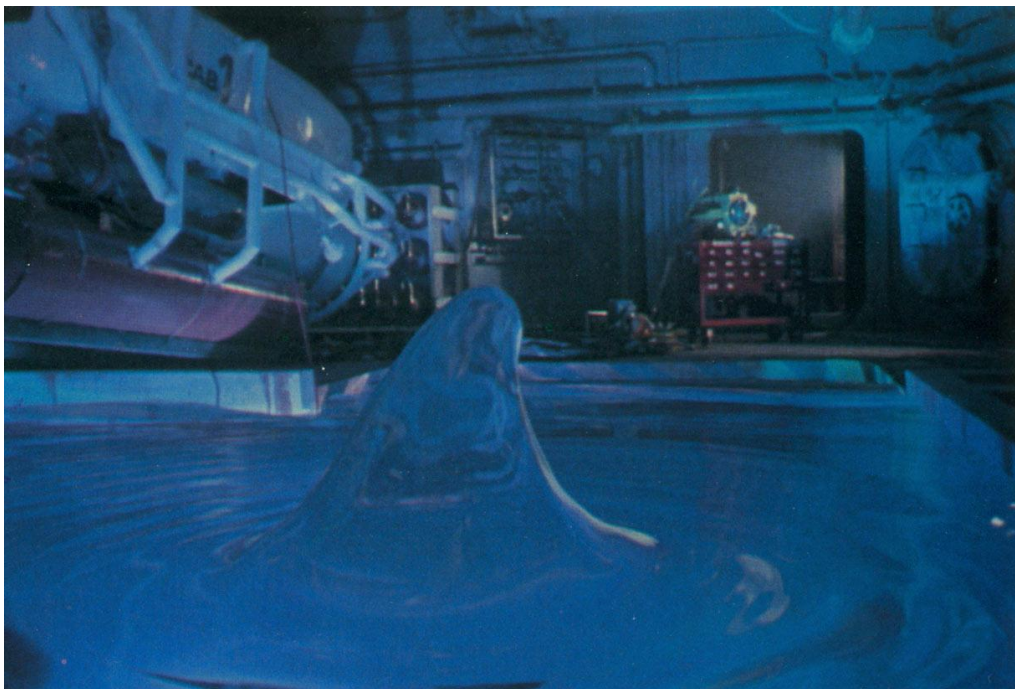
Muren still considered computer animation a better option — and even though the projected visit from Cameron materialized on short notice, the veteran effects man was determined to demonstrate both the capability and responsiveness of the ILM computer graphics team. "Dennis came in one afternoon while we were working on another project," recalled computer graphics supervisor Jay Riddle, "and told us the director of *Terminator* and *Aliens* was coming in the next day and he wanted to be able to show him something. I asked him what he had in mind and he said that Cameron wanted an effect in his next movie that looked like a giant snake made out of water. Dennis gave us what information he had at the time, and that evening I sat down at our modeling and animation system — made by Alias Research — and quickly built a bunch of still models of a tubular shape going through sort of a snakelike move. Overnight the system rendered these individual frames and by morning we were able to put them on our Abekas — a digital disk recorder — and cycle them through to create a rough sense of movement. I was not much impressed — the effect was pretty bumpy — but Dennis decided we should show it to him anyway and Cameron seemed thrilled with the results."

"It was not that this particular imagery was what he wanted," department cosupervisor Douglas Kay clarified, "but what it did was help him relieve his concerns over the reputation computer graphics has for being slow and noninteractive. Jim Cameron likes to be very much involved in every aspect of his projects. There was no way he would be content to turn his storyboards over to an effects company and then sit back for a few months and wait to see if the finished product was what he had in mind. So in that regard our test was very useful. If we could produce what we had in just a day, then certainly we could set up a scenario that would allow for fairly heavy interaction by generating quick tests and then sending them off to the director

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To produce accurate surface reflections, we drew upon imagery not necessarily in the scene, the camera and ceilings and such. John R. Riddle, the first phase of this singular objective while the plate shoot. "The main thing I did was to record every possible view of each set that was going to appear. That way we had a full library that might reflect onto it. The task was not as it might seem and I had to compromise a little on things like shooting the ceiling directly. And despite how well the sets were made, they were movie sets and so there were some parts that were obstructed by stands and other things over which I had no control. I took whatever pictures I could and then counted on the fact that with anything objectionable later on."

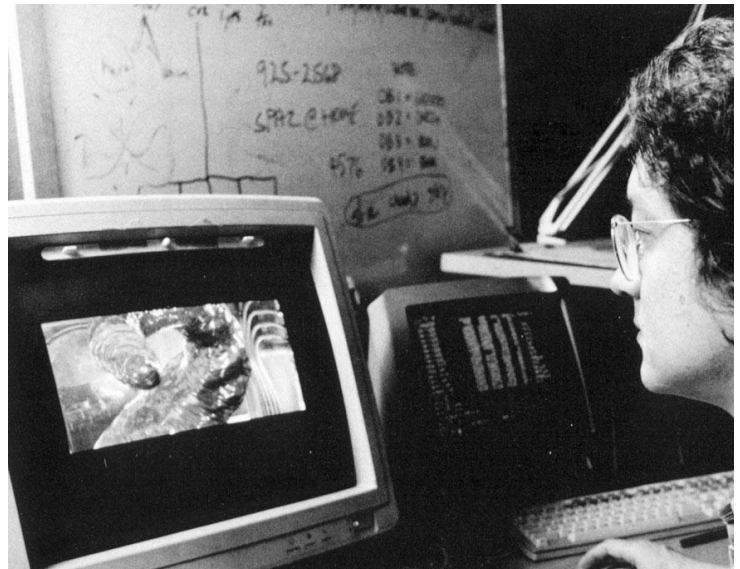
Back at ILM, the still images were digitized and input into a scanner and used to create computer-generated images that simulated the actual settings. "For each scene, we constructed a cube in computer space that contained the scanned images — ceilings and walls — that John had shot on location. Since John had to photograph under perfect conditions, he digitized the images to make sure that they would come together smoothly. He did this on a Macintosh. His brother had written to pull elements from the other, reposition objects in the frame at will, and adjust their brightness. Once they were processed, we input them into our Pixar system and used a ray-tracer to the one we had developed for refractive surfaces. Any given point on the pseudopod would reflect the color of the ceiling or the floor behind the camera or whatever — and we could control the reflection on the pseudopod."

After the refraction and reflection passes, two additional passes were accomplished to add light sources within the sets and to simulate the smoke used for atmosphere during the shoot. "It would have been possible for us to combine all the elements together," Riddle noted, "but we did them in separate passes to give us more flexibility. The composites we delivered to optical. If we had put everything together, even a minor adjustment would have taken about four days to accomplish. If we did the elements separately, we could do it overnight and build all the elements were fully rendered, each one individually onto film by Sandy Ford and the optical department where supervisor Stuart Riddle handled the final assembly."

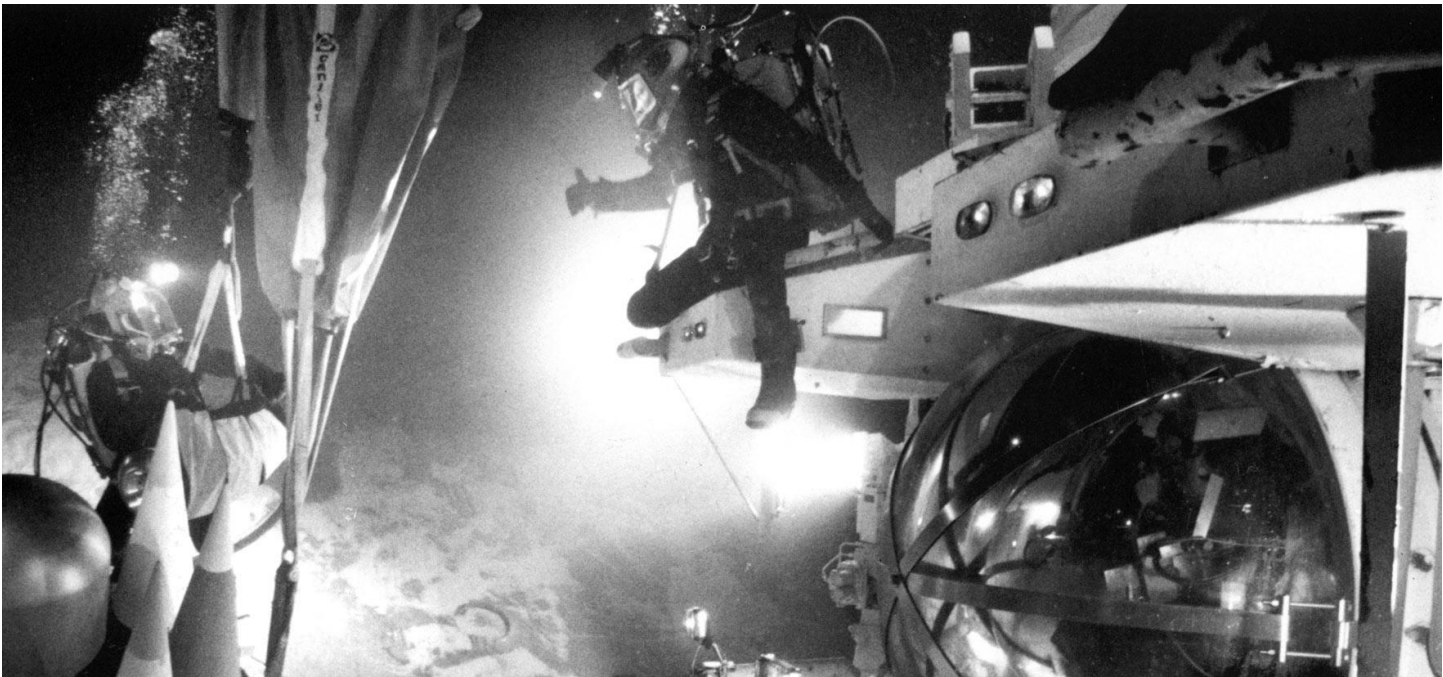
that he would just crash into the bottom and lay there totally helpless — it was like a Roadrunner cartoon."

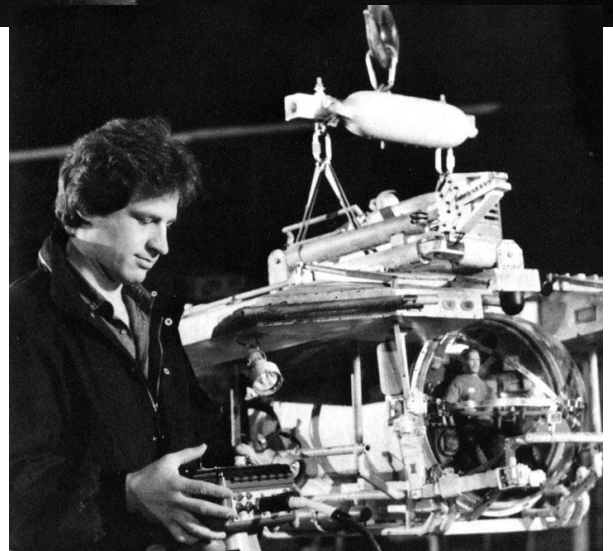
In the final days of principal photography, the main unit moved into another Owensby warehouse that had been configured into a rear process stage. "Jim likes action scenes shot documentary style with hand-held cameras and lots of movement," stated Bruno, "which is why process works so well for him. The type of work he does would be almost impossible with bluescreen. Process is not very fashionable these days, but the techniques Jim uses tend to obscure its lack of resolution. My input was that rather than do four-perf process as he had in the past, we should go instead with either 65mm or Vistavision and try to get the highest possible image quality for the rephotography." Though a full-size mockup of the *Benthic Explorer* bridge was constructed for scenes with the actors, the remainder of the ship existed only in its miniature form. Consequently, much of what was being seen from within was rear-projected plate material photographed during the ocean shoot off Westport. To open up the storm sequence and sell the scale of the ship, an elaborate process shot was devised. "What we wanted," Bruno recalled, "was a shot that began with a view looking out over the helipad toward the raging sea — one of our storm plates photographed from the bridge of the model *Benthic*. A crew member scrambles up some stairs in the foreground while behind him the starboard bow takes a forty-foot wave. The camera then pans and moves with the man as he runs down the back side of the bridge revealing the *Albany* off in the distance as it, too, is struck by a monster wave. Two separate process screens and projectors — positioned at ninety-degree angles — would be needed for the shot. Also a lot of wind and water effects on stage. We looked at real Jacques Cousteau storm footage with the idea of duplicating those kinds of images — hundred knot winds, guys being blown around, water hitting the lens and washing over the deck — things like that. It was a major shot with a lot of production value." Other shots on the *Benthic Explorer* — most of them inside the pilothouse — also featured plate material from the Westport shoot projected onto process screens visible through plate glass windows.

The completion of main unit shooting in mid-December triggered a stampede for the studio gates as dog weary cast and crew members headed home for the holidays. The underwater model unit was still on the job, however, making nightly forays into the tanks despite sub-freezing weather and occasional snows. Among the later sequences recorded was the crash of the *Montana* — another large-scale miniature constructed by Wonderworks. "The submarine was about forty to fifty feet long," said Brick Price, "and was built with a giant tubular armature that rotated like a spindle for the scenes where it had to crash and roll down an incline. We built it in three parts











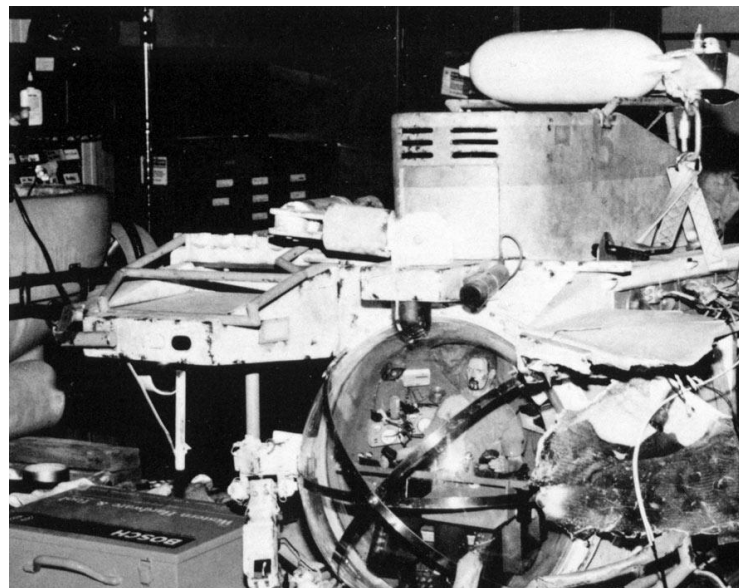
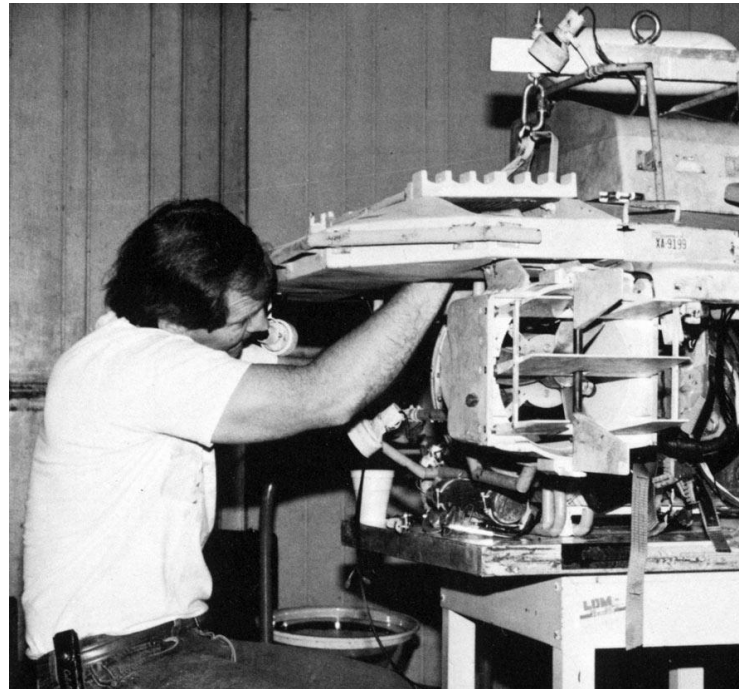
A full run during the underwater chase iature ocean bottom from end to end — eighty feet long by forty feet wide. Rocks set pieces would be shifted about as nee fact that a single expanse was being used not that difficult to disguise," noted Roring in total darkness with only the light our surroundings. At any given point about fifteen-foot visibility. We would rocks and sand — and then for a later couple of feet and it would look like an e Adam Gelbart did most of the set dress underwater unit was working at full tilt, it tivity was distressingly low. Cameron 1 after the main unit wrapped and spent wh personally directing the chase. But it was that the sequence would not be compl break and the final pullout from Gaffney, underwater work had produced only ten clear to all that the unit would have to at a later date. There was still much to

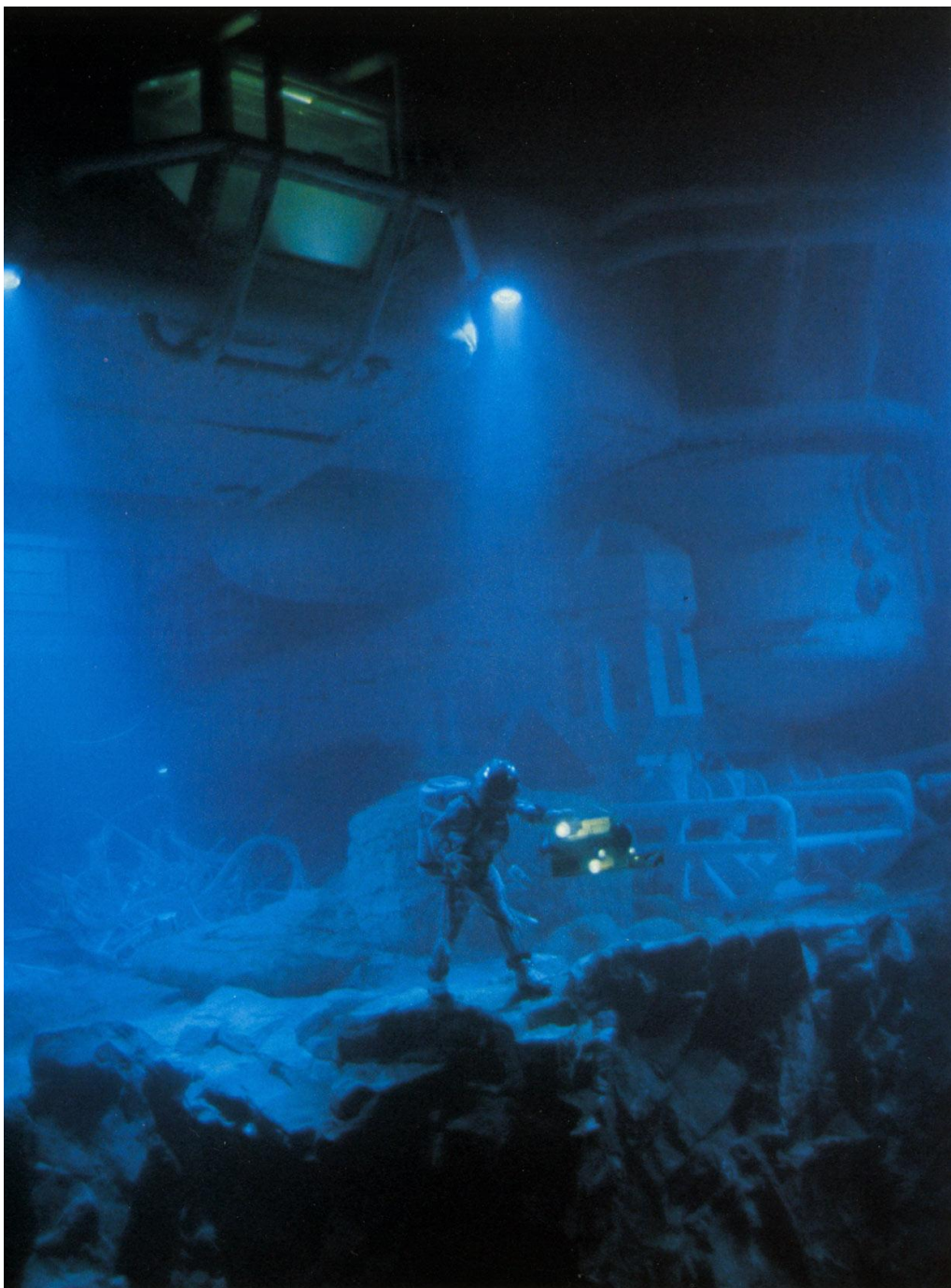
Cameron had spent months trying to nonterrestrial intelligence — NTI — out-ists. "It was always my intent that the NTI was critical to their design — but I did on the nose with it. I went through to shamelessly shredded expensive coffee tures of interesting shapes and textur

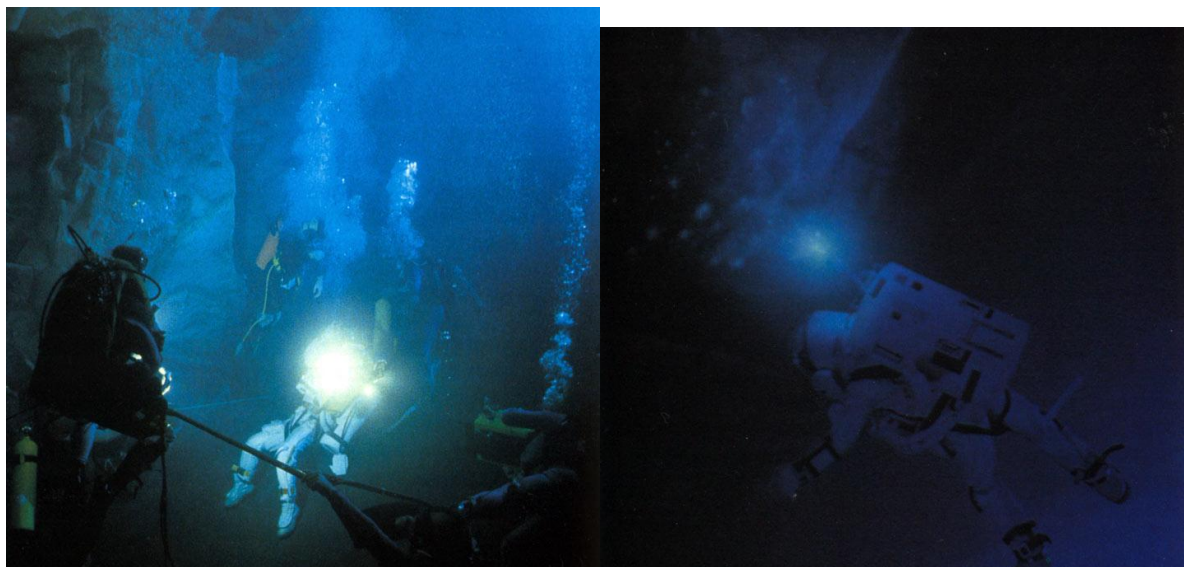
tanks and then plug up one eighteen-foot wall with a giant piece of plexiglass. That way we could put a rear process screen inside the tank — in the water — project plate material through from the outside and rephotograph it with actors swimming in the foreground. As things got crazier and crazier, however, it became apparent that the tank was not going to be finished in time for us to do the underwater process and be out of the studio by our deadline. So we decided to scrap our original approach and build a portable tank somewhere in the Los Angeles area."

After scouring the Los Angeles basin, Laura Buff came upon the Harbor Star facility in San Pedro which seemed ideal. "It was an old World War II sea plane hangar," Bruno continued, "so it was very large and had thirty-foot ceilings — plenty of room to wreck things. Also it was right next to a shipyard, which we thought might be helpful if we had to do anything more with the *Benthic Explorer*." As the production wound down in Gaffney, set pieces and miniatures were shipped to the San Pedro facility where the postproduction effort would recommence after the holidays. Much of the work would take place in the process tank hurriedly assembled on site by construction coordinator George Stokes and his crew. "The tank was framed in steel and was twenty feet wide by forty feet long and twelve feet deep. We could have managed with something smaller for the process work, but we also decided to shoot the NTI material there and we needed a tank for second unit photography — so it had to be large enough to accommodate extra divers and set pieces and anything else that might pop up. At one end of the tank we installed our plexiglass panel which was fifteen feet wide by eight feet high — and five inches thick to withstand the water pressure!"

A portion of the Harbor Star shooting schedule was reserved for Steve Johnson and his crew to create the imagery for a crucial sequence inside the NTI city. Bud has been transported to a small chamber by his alien benefactor and deposited gently onto the floor. Moments later, the water within the room is bisected by a shimmering interface that gradually expands outward and over the oxygen starved diver — in the process forming two walls of water with a corridor of dry emptiness in between. The water effect was among the last things shot in Gaffney. "We used a gravity gag," explained Cameron. "The set was made from steel-reinforced fiberglass — and for the crucial scenes it was turned on its side and lowered into B-tank with a big crane. The camera was bolted to the set on its side and a stunt double was strapped to the set on his side. Then we just lifted the whole thing slowly out of the water. Since there is no gravity reference, the set appears to be in a horizontal position with a vertical wall of water pulling back. To compound the illusion, we also put in the other wall — which really nails it. We did that by removing the structure, which was off center



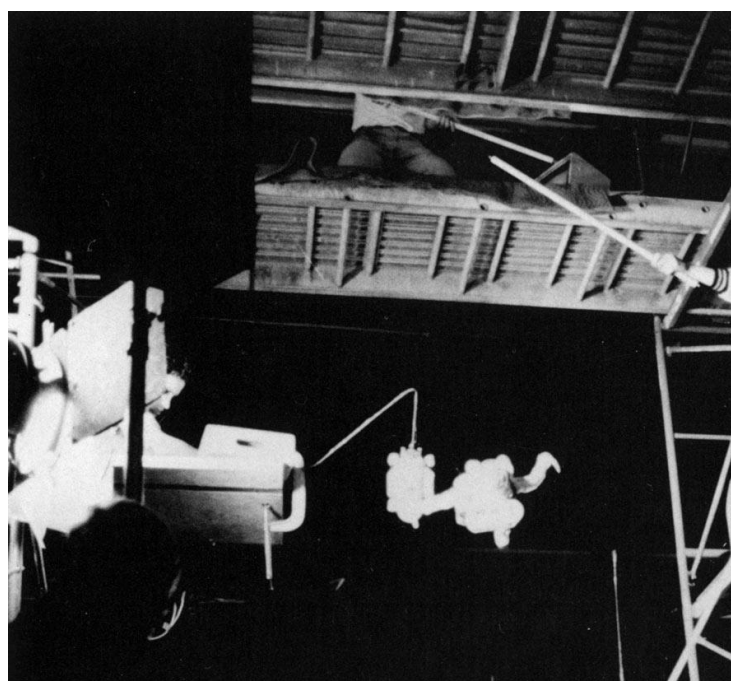




actual organisms — which was not my intent. I did not want it to seem as though we were meeting the aliens — only their artifacts. But their artifacts are not quite on our plane of existence.” Delighted with the creature designs, Cameron turned once again to Steve Burg for input on the alien technology.

“For years Jim had been collecting pictures of various sea creatures,” noted Burg, “and the manta ship was based on one of those — a midwater mollusk with a weird sort of membrane. Like the creatures themselves, the craft was bioluminescent with a transparent blown-glass look. It was supposed to have a wingspan of fifty to sixty feet and function something like a helicopter or reconnaissance craft. I came up with several different concepts during my first week on the assignment. My favorite was pink and resembled a floppy beret with some opaque spherical shapes inside that could have been interpreted as control pods or cockpits housing the unseen aliens. Jim preferred another rendering which he adapted in a drawing of his own by changing the front end around and giving it a concave shape with some intakes that swooped out under the belly. The interior characteristics — which looked a bit like interconnecting thin-stemmed wine glasses — he kept pretty much as they were.” Also on the design agenda was the scout ship. “At first the scout ship was going to be a remotely operated vehicle — very small — but eventually it grew to about the size of a large motorcycle. One of my early ideas was to make it like a giant paramecium, but the drawing I came up with to illustrate it was pretty embarrassing — at least in *my* mind — so I tossed it out. A little while later, Jim came by with John Bruno and together they fished it out of the trash and said, ‘Hey, that’s it!’ It was not a bad idea — just a poor rendering.”

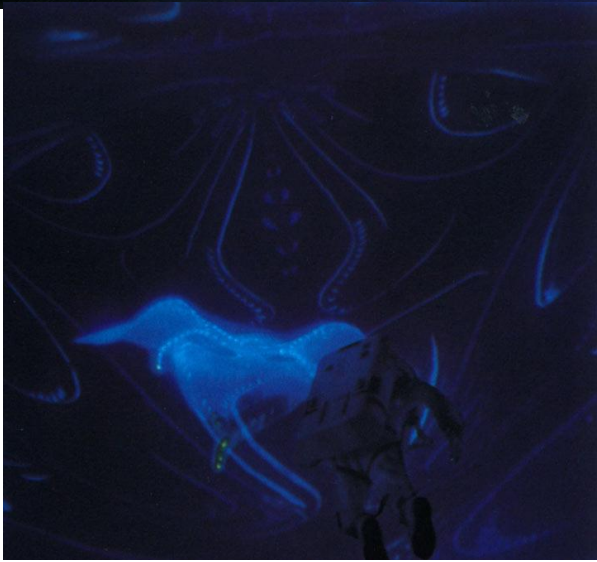
Of all the models constructed for the film, the scout and the manta would be the most difficult — both aesthetically and technologically. “The original drawings were very beautiful,” stated Alex Funke, “but they offered no clues as to how the ships might be built. There were glowing balls and spindly structures and enclosed glows inside faintly delineated surfaces — and we had to figure out how to turn those ephemeral concepts into physical objects that we could shoot.” Dave Goldberg and his crew started on the scout ship by sculpting a three-dimensional form that was then used as a matrix to vacuumform the hull out of highly polished uvex. Within that hull, Funke designed a sculpted plexiglass framework and then an inner structure made of nested glass shapes. “Among these complex cones and cylinders and rings was an evacuated glass vessel with very low pressure. Inside it we put a gas mix that could

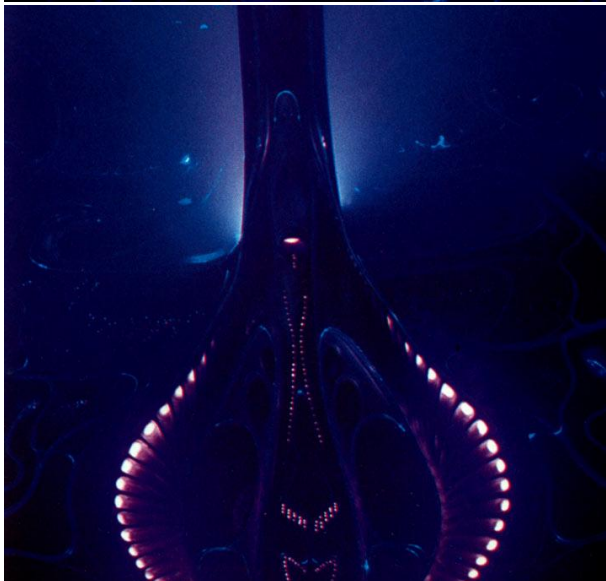
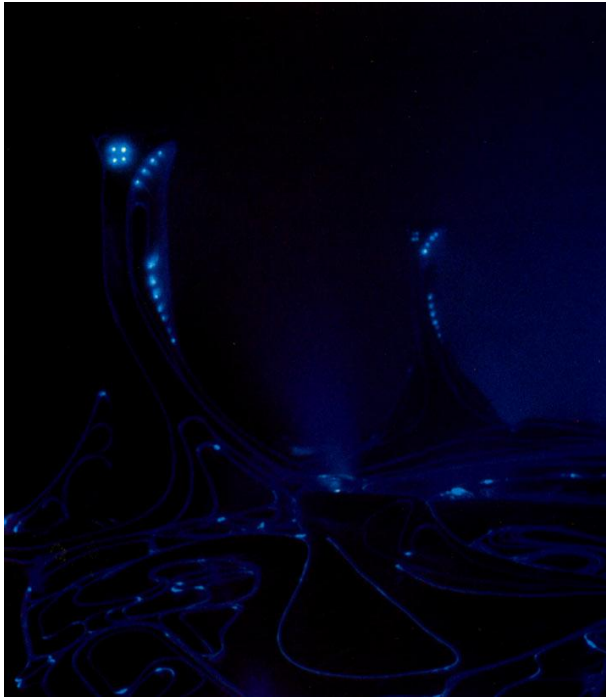


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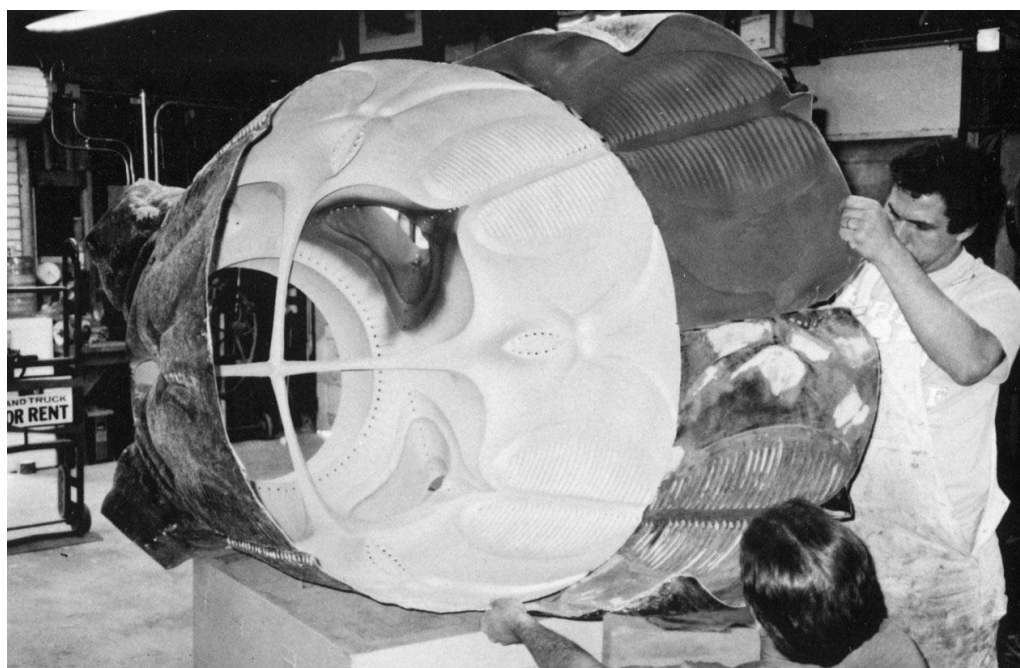
an effect somewhat like a turbine. It did not really look like it was spinning, but it was complicated enough and interesting enough to give the idea that it was somehow generating power. For our last kinetic piece, I took three little brake light bulbs and wrapped them with black foil that had small holes punched into it. In a smoke environment, the light shining out of those holes created very fine beams that were almost parallel. The bulbs were put on a motion control device to move them up and down — which produced an effect like light streamers wiggling around. We double-exposed that over the back of the ship when it was under power.”

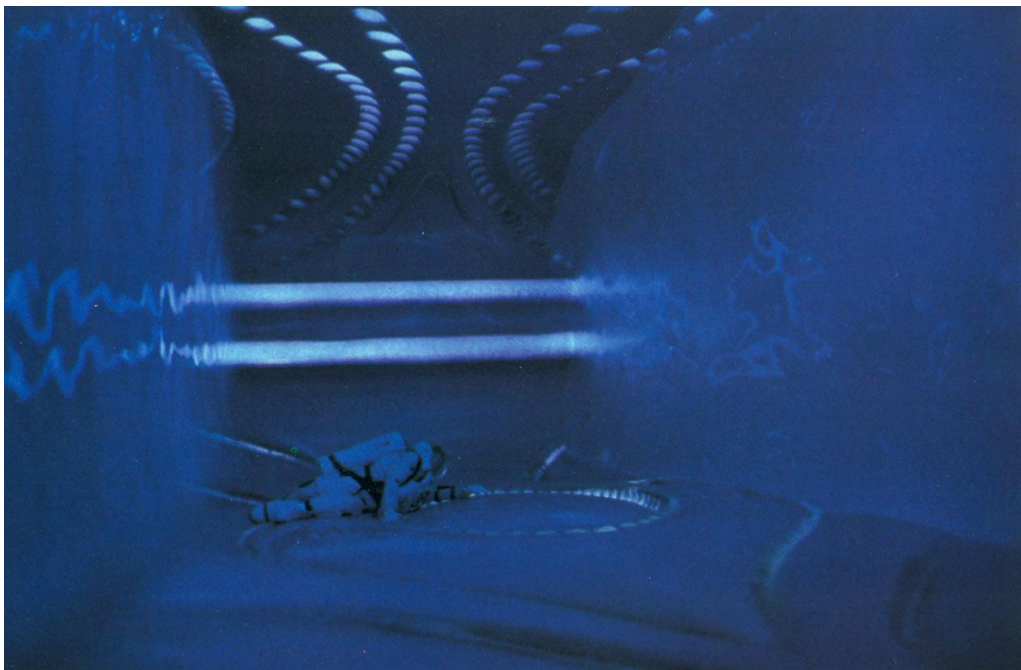
The scout ship would be seen only fleetingly as it darted about. The manta would be observed more lingeringly. Consequently, it demanded more elaborate versions of some of the devices incorporated in the smaller craft. “Inside the manta was a glow flask like the one in the scout except that the modulation was a little different and it was placed in the back of the model. There was also a pair of turbines based on the same principle as the one in the scout — except I took a series of fiber optics and put them end to end so that when we passed a light source over one extremity, it produced a traveling band of light like a little comet zooming around in a circle.” The manta also featured conventional neon — plus some laser effects created by Gary Platek. “The problem with fiber optics is that it is difficult to get a lot of light through them. But with lasers you can pump an enormous amount of light through the fibers and actually have usable illumination coming out the other end.”

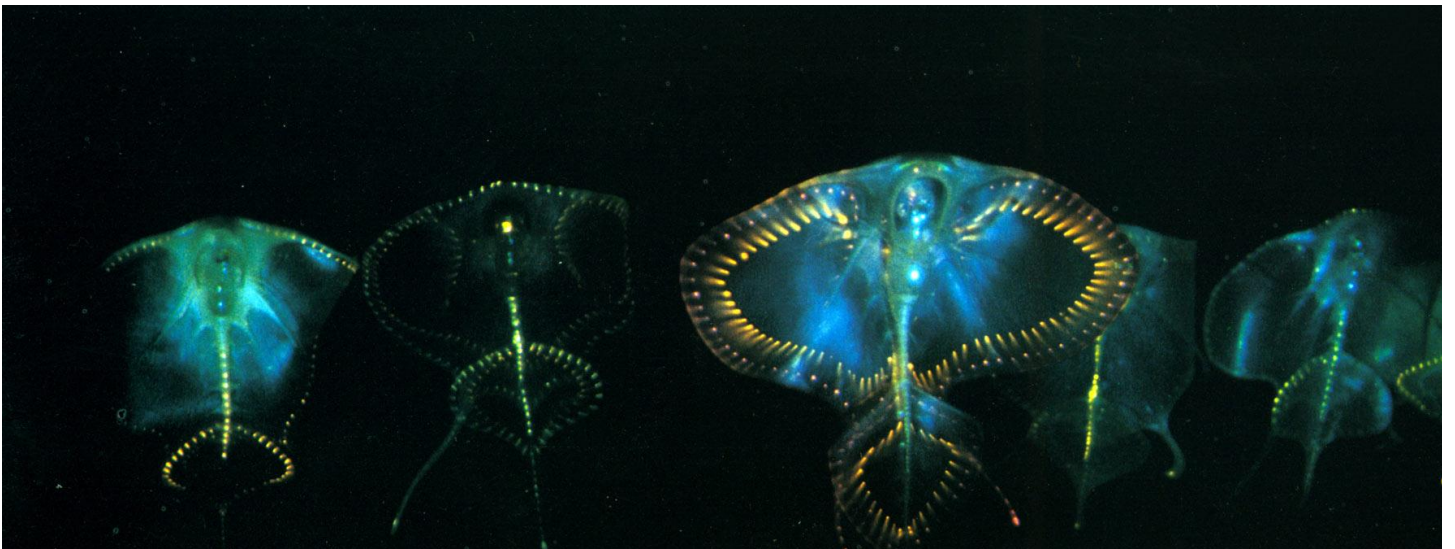
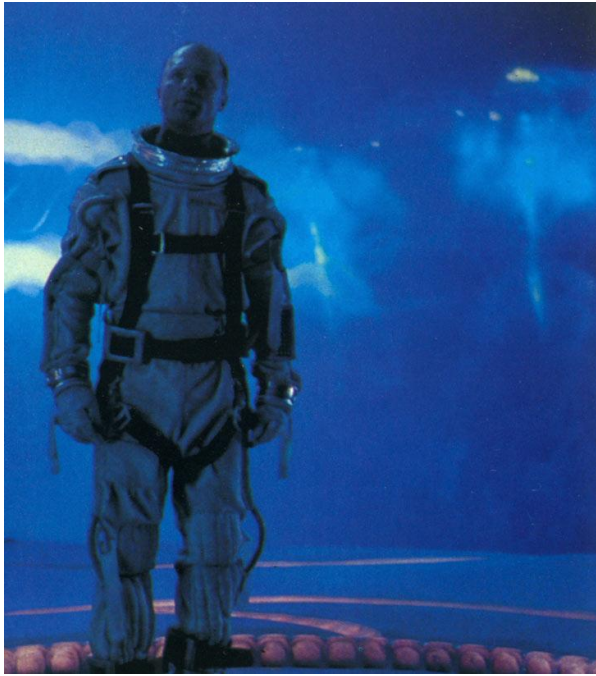
Both vehicles employed clear plexiglass sections that were not self-illuminating, but were rendered discernible by the ways in which they refracted the light from other areas. Each ship required ten or more latent image passes — all photographed against black — to achieve its final look. Most of the glow effects and light beams were recorded individually — as was a separate effect discovered by chance. In an early light test, Alex Funke noted that the uvex hull material glowed an eerie pale blue when struck by ultraviolet light — so an ultraviolet pass was promptly added to the shooting list. “In doing those ships, we had a very specific color palette that was quite limited. We had a deep blue and a little bit of red — not much — and then a pink and a few grades of cyan. Those were the dominant colors in these creatures’ lives. The only warm colors in their whole existence are the yellow and orange lights that appear on their mantles — and presumably they communicate with those colors. So part of the challenge was to find ways to use our limited palette in a manner that was interesting and did not end up looking totally monochromatic.”

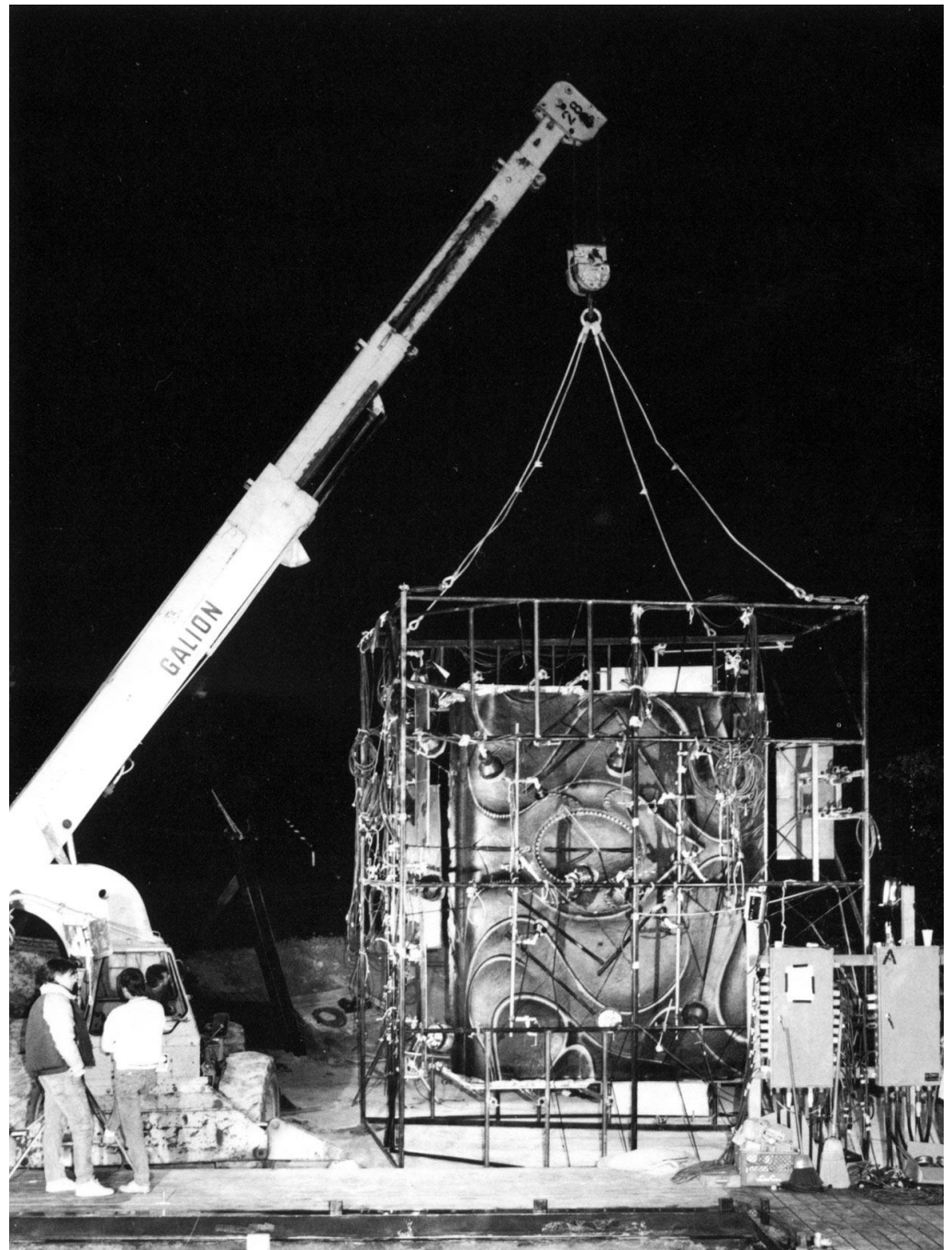
At peak capacity during the months following principal photography, effects crews were shooting on seven different stages at the Dream Quest facility. Construction of equipment and

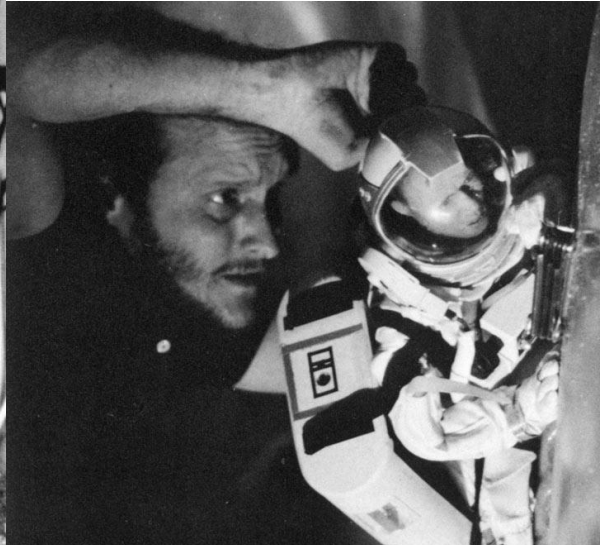
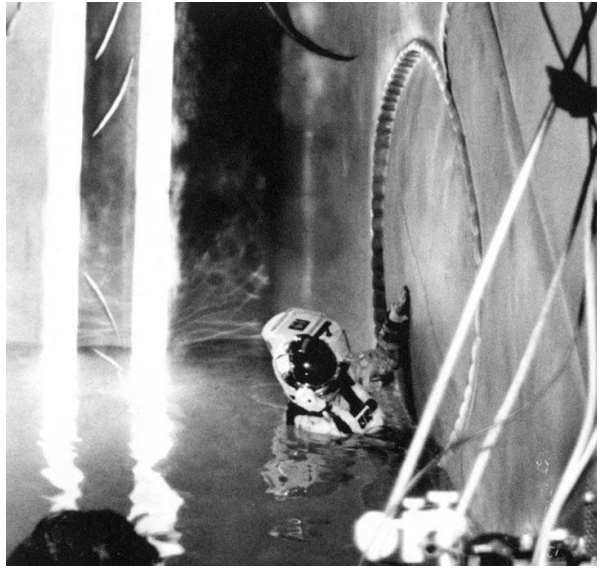
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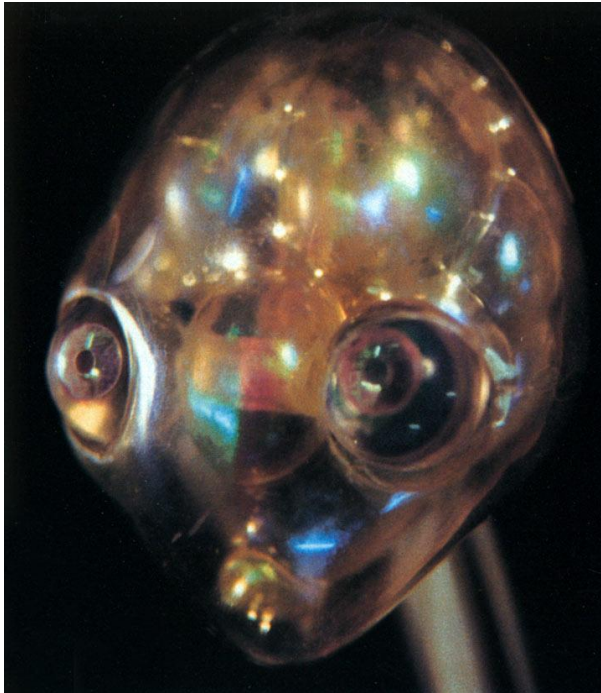












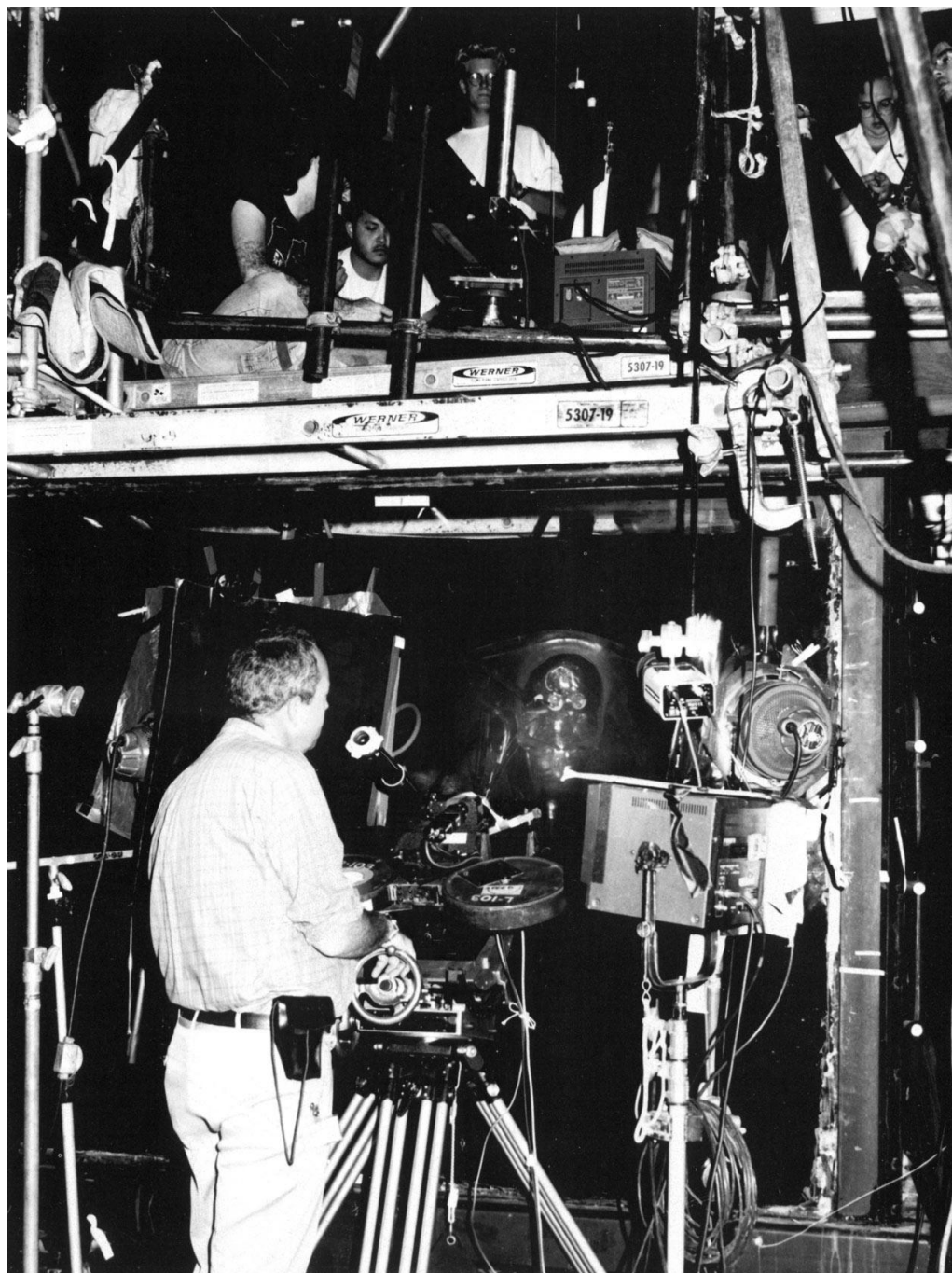
Our job was to produce the background plate where water was supposed to start spraying from one of the tubes and then the hatch blows off of it and a huge stream shoots across the set. Moments later the second tube does the same. Dave Kelsey — who was head of the effects crew — developed a two-stage effect. First there was a radiating spray as if a gasket were falling under the hatch. Then an air mortar was used to blow open the door while at the same time we released a column of water under pressure that went straight through the frame and about ten feet beyond the set before it started to fall. Very powerful. We shot at sixteen frames per second to create a staccato quality and increase the apparent intensity." On the plate, the column of water went from screen right to screen left. During rephotography, a dump tank and fire hoses were positioned out of frame and released on cue to continue the illusion of water caroming off the wall and engulfing the foreground crewman.

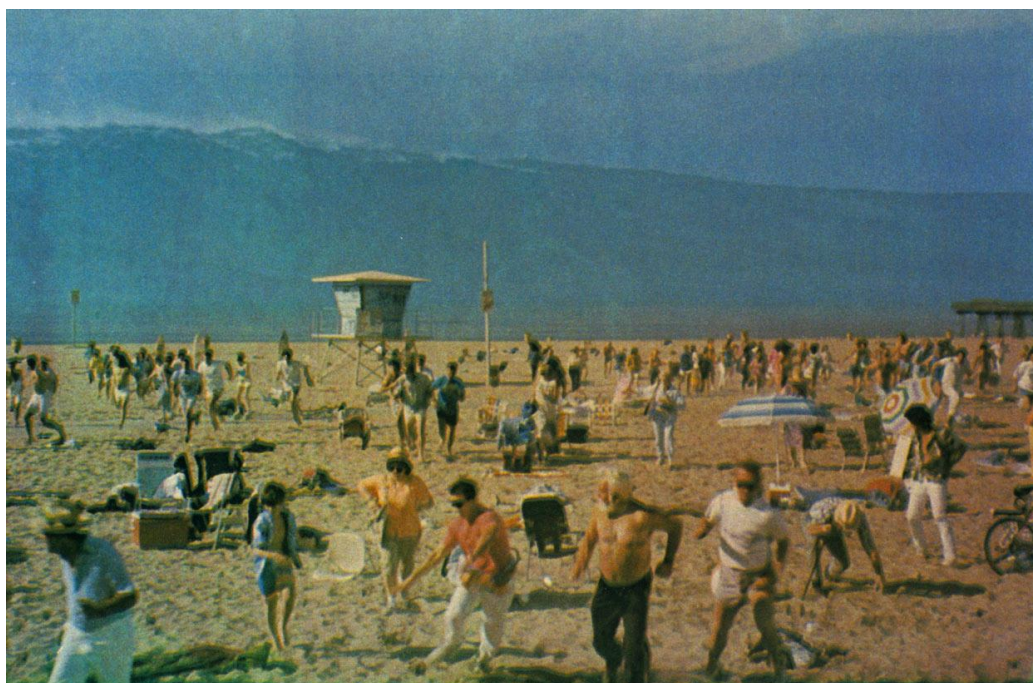
Once the underwater process photography was completed, another effects unit headed by Robert Skotak and Dennis Skotak moved into the Harbor Star tank. As effects supervisors on *Aliens*, the brothers Skotak had held the visual effects production together during some tumultuous months and had contributed more than their share to the Oscar winning effort. Cameron had sought them out again during effects bidding on *The Abyss*, but the pair had taken a leave of absence from the field and declined to get involved in anything quite so extensive. As principal photography drew to a close, however, there was still some effects work not yet assigned and the Skotaks agreed to take on a few shots.

Among the first was one of their specialty shots — a combination of live-action and miniatures accomplished through perspective trickery. What was needed was a brief cut showing Cab Three — with Lindsey and the SEALs on board — being launched into the turbulent sea from the *Benthic Explorer*. The prescribed vantage point was from atop the crane looking down past the submersible to the launch well and some crew members on the deck. "The idea was that we would use one end of the tank combined with a quarter-scale hanging miniature for the launch well," explained Dennis Skotak, "and then dress the floor below to look like the deck of the ship. With the set and miniature aligned and the aperture closed down, the extras — who were actually ten feet below the water — would look like they were about fifteen feet above it."

Pat McClung was engaged to execute the miniature work. While he personally attended to converting one of the Conti submersibles from a white Cab One to a yellow Cab Three, brother Jerry McClung fashioned a like-scaled launch well section to outfit one corner of the tank. Floating bumpers and other detail pieces were provided by Ron Knyrim and Steve Patino. "Unlike most of our perspective shots where everything

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For most of the high-speed chase scene, Cameron had the camera mounted on the diver developed by his brother. One shot in particular was for something even more dramatic. "Near the end," said Conti, "the two subs are ramming Flatbed into an outcropping that causes one of its pontoon wings. Anticipating this, a bunch of materials and ended up making wings from a very thin polyester that shatters almost like an eggshell — and looked very realistic. As the breakaways they were pretty involved because they had to be aged precisely and rigged with lights to photograph the shot, Cameron wanted to make it look like a rock and continue on — but upon impact, the sub turned out and came to a stop. To stabilize the shot, he suggested that its backside be connected to an underwater scooter whose job was to turn the sub from turning and also propel it forward. Jim decided to get on top of the pole with the whole rig into the rock. We were all concerned it was a 'cowboy' — but the shot turned out wonderful. It took on it and the wing just peeled back into the camera."

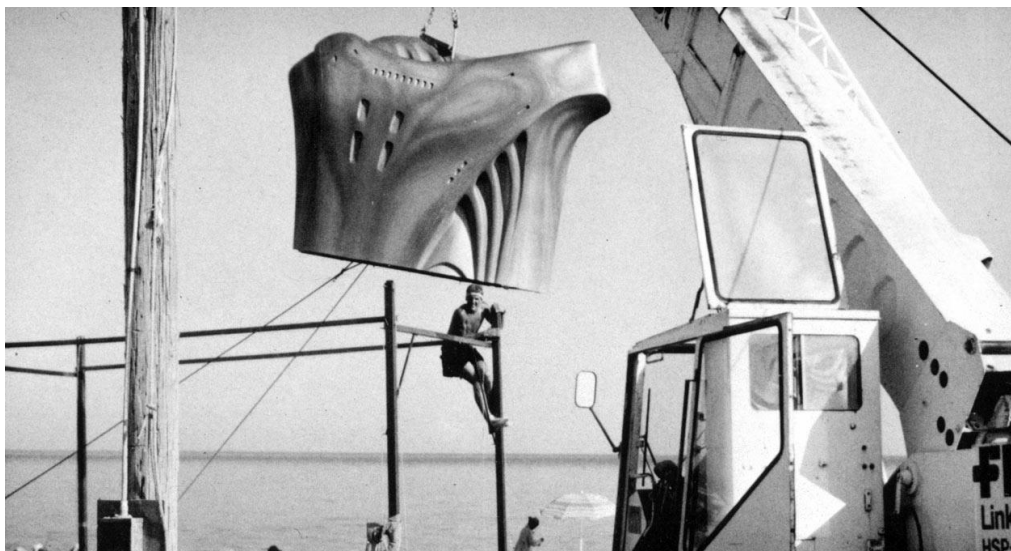
Elsewhere in the pool, Mike Cameron was preparing for the demise of Flatbed as the sub tumbles backward into the abyss and implodes. "Implosions are very difficult," Cameron said. "He was very specific about what he wanted for the previous live-action shot where Flatbed goes over the edge of the cliff and Coffey reaches up at the edge. He told me he would be in quite close to the edge. There would be a lot of interior detail and it would be an extremely accurate puppet. We had ten days to build two quarter-scale miniatures for the bill. I started with the idea of pulling a vacuum chamber and then squibbing it with charges. The chamber — fifteen inches in diameter — was a test tube with its rounded bottom representing the dome. I built the interior of the submarine out of small pieces of plastic. All the lights were hand-scratched and waterproofed. The puppet was made by Mark Williams — was cast over



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Footage of Bud emerging from a portal on the inner disk was shot months later at Harbor Star. Since no full-size set existed, the Skotak brothers were called upon to do another of their false perspective shots. "The opening was supposed to act like a drainage vent of some sort," said Dennis Skotak. "As Bud walks up and out of it, water is flowing into it from the surface of the ark. The foreground perspective piece was built to our specifications by Dave Goldberg and the Design Setters crew. It was sixth-scale — about nine feet across. Kevin Mack and Jeff Loy put a lot of effort into painting it to create the abalone finish that Jim wanted — very deep and polished with an iridescent feel. Behind it we put a sky backing — about twenty-seven feet long — and in front of the backing we placed a four-foot-tall spire sculpted by Nick Seldon and Roy Knyrim. What made the shot difficult was the fact that water needed to flow into the opening. For that to happen, we had to tilt the set downward slightly — but since Ed Harris was about thirty feet away in the distance and had to be visible through the foreground piece, we had to build a ramp for him and then elevate the set about twelve feet off the floor and tilt it down. Another problem was the lighting. Originally we planned to shoot outdoors since it was an exterior day shot, but it was winter and the weather was unpredictable so we decided to move it inside. To hold focus and make it look bright enough we needed a lot of light."

Unlike the Cab Three launch shot, it was decided that the emergence of Bud from the ark should be assembled optically. "For the water to look in scale," stated Bob Skotak, "we knew we would have to shoot the foreground at seventy-two frames per second. It would have been impossible for an actor to pantomime at that speed. If we had done it as a double pass shot in camera, it would have been equally impossible to predict when the water flow would look ideal. So we decided to do it optically. We did a lot of tests to come up with a substitute for seawater that would scale better than the real thing. Rubbing alcohol had the lowest surface tension — which is what we wanted — but undiluted it had a dulling effect on the paint job. Eventually we developed a concoction of rubbing alcohol, distilled vinegar and a little water — plus some milk and coffee for color and a mixture of salt and dirt for body. It actually scaled quite well. Another thing we did was lay down lines of baking soda on the set so that when the vinegar in the solution hit them it would create a fine bubbling effect like miniature ocean foam." Since a human being could not actually emerge

The large-scale emerges from two Navy thirty-foot previously Westport's the other variation. scale was low shoot Albany is 1 as the alien beneath it of the full shot high-Fantasy II a shallow constructs seventeen replicas of the Benthic several Na attached to Hydraulics were used model up were empty waves of the ark the Albany destroyer originally bottom — equipped and simul Also its n designator the shot c



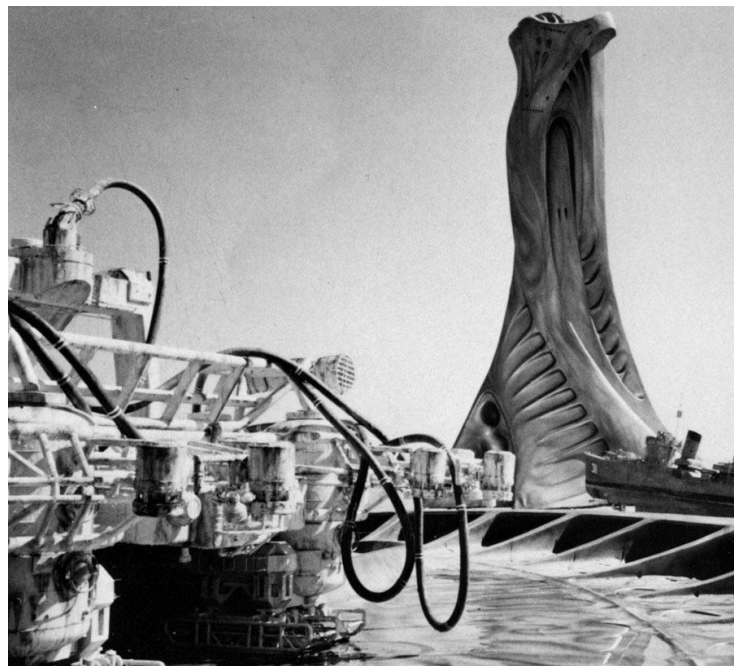
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image — so it is difficult to believe it, no matter how good it is. Actually the *biggest* limitation of the sequence was point of view. Where are we? What the hell are we doing standing on Santa Monica Beach? In *Aliens*, I had Sigourney Weaver and her reactions to make me believe that the alien queen was there and that it was a living creature and not just a bunch of fiber-glass and rubber. She invested the effects with life and gave them reality. In *The Abyss*, the wave sequence took place outside the immediate perception of any of the main characters. It was cold and objective. Boom! — we're on the beach at Santa Monica. Now all of a sudden the audience is forced to be a character. There is no one on the beach for us to relate to — to give us a conduit for our emotions and perceptions. It is just de facto — here is a giant tidal wave. I hated to see it go — but the film works fine without it. The resonances of its message are still intact. The alternative would have been to go in with a machete and cut a minute here and thirty seconds there to the point where you risk ending up with a film that makes no sense and has no visual elegance."

Although the visual effects work in *The Abyss* is clearly more abundant and more polished than that found in any of his previous films — even the Oscar winning *Aliens* — Cameron is ambivalent about his growing reputation as the grand master of technological thrillers. "I confess to being easily seduced by technical situations. We did a lot of stuff on *The Abyss* that I would not have even *thought* of doing on *Aliens* — a lot of things no one has ever done before. And I put a lot of personal attention into making all of it as perfect as possible. The only way for me to do a film and not get totally involved in the effects is to make a film that *has* no effects — but the relationship is definitely a love-hate affair. I hate effects because I know they are an Achilles heel — a weak link in the process where your film can fall down badly and lose its sense of reality. On the other hand, effects can also be the place where you blow people away. There are a *lot* of effects in *The Abyss* — most of them very good. But the most powerful moments — the moments I am certain will blow people away in *this* film — have no effects at all. I am pleased with that, and I think it's a positive step forward in my personal evolution as a filmmaker."



The Abyss photographs copyright © 1989 by Twentieth Century Fox Film Corporation. All rights reserved. Production unit still photography by Richard Foreman and Walt Clayton. Dream Quest still photography by Jim Alling, Brian Adams

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